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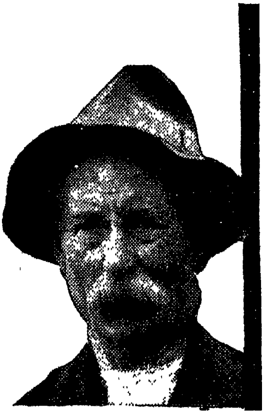

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WITH

AN ABSTRACT OF THE PROCEEDINGS AT BOARD AND GENERAL
MEETINGS, AND THE PREMIUMS OFFERED BY
THE SOCIETY IN 1942

PUBLISHED ANNUALLY

FIFTH SERIES

VOL. LIV.

EDITED BY JOHN STIRTON, SECRETARY TO THE SOCIETY

EDINBURGH:
WILLIAM BLACKWOOD & SONS LTD., 45 GEORGE STREET
AND 1-8 BATEMAN'S BUILDINGS, SOHO, LONDON
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JOHN STIRTON,
Secretary.

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TRANSACTIONS

OF

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

GRASS SICKNESS IN HORSES.

A REVIEW OF THE PRESENT KNOWLEDGE OF THE DISEASE, WITH PARTICULAR REFERENCE TO THE NATURE OF THE CAUSAL AGENT.

By PROFESSOR J. RUSSELL GREIG, Director, Moredun Institute,
Animal Diseases Research Association, Edinburgh.

PART I.

HISTORICAL AND GENERAL.

Historical.

IN May 1911 the disease of horses which has since been named grass sickness appeared at a military training camp at Barry, near Dundee. Possibly some acute cases occurred previous to 1911 and were mistaken for subacute impaction of the large colon, but the chronic form of grass sickness in its clinical manifestation is remarkably characteristic, and is thus readily recognised; therefore it may be inferred that the disease was not present in any considerable incidence in Scotland previous to 1911.

In the years immediately subsequent to 1911 grass sickness does not appear to have made any considerable progress, and was largely confined to the Parishes of Barrie, Monifieth, and Strathmartine, but in the succeeding years it gradually extended inland through Angus and Perthshire (Strathmore, 1916), and spread north through Kincardineshire, Aberdeenshire (epizootic in Turriff area, 1922), Banff (Spey Valley, 1920), Moray (Elgin area, 1920), and Nairn. These extensions were continuous, but did not always appear to be definitely progressive in that contiguous areas were not always affected in chronological sequence. The disease became prevalent also in Fife (1919) and in the arable portions of Inverness-shire and of Ross and Cromarty; there is a considerable incidence in Wigtown and Kirkcudbright, in the area of the Lothians, and in the Tweed Valley, while numerous cases have now been recorded from Lanarkshire, Renfrewshire, and Ayrshire, districts which until comparatively recently remained relatively free from the disease. In Ayrshire, in which county grass sickness did not assume epizootic form till 1928, it was observed that many of the earliest cases occurred in the region of the coast extending from Ayr to Girvan. In England it commonly occurs in Northumberland and in Cumberland; relatively small outbreaks have been recorded from various areas, such as the Severn Valley and districts in Essex and the East and North Ridings of Yorkshire. As the result of a survey carried out by the Agricultural Research Council in 1939, it was reported that in recent years several hundred cases had occurred in different parts of England. Nevertheless, in its epizootic form grass sickness is largely confined to the mainland of Scotland and to that area of England lying northwards of a line drawn roughly from Morecambe Bay to Flamborough Head. The disease has also been reported as occurring in Brittany and in West Flanders.

As an example of the extension of the disease in affected areas, Strathearn may be particularly cited. Until 1918 grass sickness was apparently confined to the east of the River Tay. In 1918 or 1919 it appeared to the west of the Tay and progressed annually by definite stages westwards up Strathearn and Strathallan. These and other observations suggested the possibility that a living vector carried a hypothetical infective agent. (This is discussed later.) The causal agent does not appear to be wind-borne, since the prevailing winds in this district (Strathearn) are from the west.

It has been considered that birds may act as carriers; if so, it might be assumed that the causal agent could quickly be carried some considerable distance, but the relatively close regional distribution of grass sickness would appear to negative the likelihood of birds being concerned in its transmission. For example, the disease for several years (1913 onwards) occurred in Angus in relatively high incidence before it appeared in Fife in 1919 (outbreak at Tents Muir), and, while it is prevalent in Strathearn, it has remained practically absent from the Carse of Stirling, and broad rivers, such as the Tay, and ranges of hills would appear to act as barriers to its extension.

The possibility of wild mammals or insects acting as vectors is referred to later (p. 25).

Species Affected.

The horse appears to be the only animal susceptible to the disease. Asses and mules are very rarely kept in the affected districts; it is possible that they may be susceptible, but the other domestic animals and also man are apparently immune.

Breed Susceptibility.

All breeds appear to be equally susceptible, although several practitioners are of opinion that the Shetland pony enjoys some degree of immunity.

Age Incidence.

Grass sickness occurs in horses of from one year to over twenty years old. It appears to be of very rare occurrence during the first year of life, and is not known to occur in suckling foals.

Figures compiled for the writer by the National Farmers' Union Insurance Society are shown in the following table:—

AGE INCIDENCE, 1939 AND 1940.

Age.	Cases of Grass Sickness.		Total.	Horses insured in 1939-1940.	Mortality per cent.
	1939	1940.			
2 years and under	9	5	14	539	2·59
3	15	17	32	709	4·51
4	25	31	56	770	7·29
5	20	16	36	764	4·71
6	16	18	34	726	4·68
7	7	10	17	655	2·61
8	9	4	13	583	2·23
9	4	8	12	612	1·96
10	1	8	9	445	2·02
11	3	2	5	346	1·44
12	..	2	2	171	1·17
13	..	..	..	165	..
14 years and over	1	..	1	132	·76
TOTALS	110	121	231	6617	3·49

Percentage Mortality.

Between three years and six years old	5·32 per cent.
Other ages	2·00 „
All ages	3·49 „

The percentage mortality also represents (almost entirely) the percentage morbidity rate; it therefore will be observed that the disease incidence between the ages of three and six years inclusive is relatively very high (5·32 per cent)—with the peak at four years (7·29 per cent)—as compared with the incidence in the other age groups (2·00 per cent).

Sex Incidence.

In our observations, cases of grass sickness occur in approximately equal numbers in both sexes. The great majority of male horses are, of course, geldings, but the disease also occurs in the stallion and in the pregnant mare.

Of 150 consecutive cases observed during the years 1938, 1939, and 1940 the sex incidence was: males, 118; females, 132 (1 : 1·12). No figures indicating the number of mares and geldings in the affected districts are available, but it is assumed that the sexes are approximately equal in number.

Environmental Conditions of Occurrence.

The disease almost invariably occurs in horses that have had access to growing grass, and, therefore, is particularly prevalent among those at pasture. It is only on rare occasions that cases are encountered in stabled animals, even in those to which grass cut from affected pastures is fed. In the two principal cities situated within the epizootic areas—Aberdeen and Dundee—it is estimated that during the last twenty years a horse population averaging approximately 2500 has been annually maintained. Throughout this period the incidence of the disease in these two cities and in the several towns in the areas concerned has been very low, and indeed when such cases are encountered they are regarded as quite remarkable.

The great majority of cases occur after the horse has been put to grass for two weeks or longer. Of fifty consecutive cases observed, one case was attacked after having been turned out to pasture for three days, two after four days, one after seven days, one after ten days, and the remaining forty-five had been continuously grazed for at least a fortnight on the same pasture.

It has been frequently observed that horses are commonly attacked shortly after they have been moved from one pasture to another. Of fifteen consecutive cases:—

In 10, the pasture had been changed 2 days previously.
„ 1, „ „ „ 3 „
„ 3, „ „ „ 4 „
„ 1, „ „ „ 7 „

Seasonal Incidence.

In the affected districts it is the practice to put horses out to grass during the day early in May, and at the end of that month they are turned out to graze throughout the entire day and maybe the night. Cases may be expected to occur in considerable numbers after the middle of May, but the great majority of cases (60 to 75 per cent) occur in June.

After June the disease incidence shows a rapid decline, and by autumn it has fallen to a low level. During the autumn and throughout the winter and early spring occasional cases occur at irregular intervals in colts at pasture, even during periods of hard frost and when the ground is covered with snow. The disease not only occurs in its highest incidence in June, but at that time the great majority of cases are acute and peracute in character; as the season advances, however, the disease tends to become more chronic in its manifestation.

Weather Influence.

It is believed by many veterinary practitioners that a period of fine, warm, dry weather tends to increase the disease incidence, and that during periods of very wet, inclement weather the number of cases declines. It has also been considered that ground frost in the early morning is followed by a relatively large number of cases, but we have been unable to determine the existence of a correlation between the occurrence of the disease and any particular climatic condition. This has been checked by meteorological records. It is possible that there may exist a relationship between the seasonal prevalence and a combination of two or more climatic or other factors, but this is at present not known.

Topographical Conditions.

Grass sickness is associated with the most varied topographical conditions. It is encountered at all elevations from sea-level to at least 1200 feet, and under widely varying conditions of pasturage: sound, well-drained fields; boggy marsh; lush clovery second and third year's grass; hill sheep grazings; poor, scanty, rank, and weedy herbage; on close-cropped, old permanent pasture and fine seaside turf. Cases appear to occur as readily on northern and eastern as on southern and western exposures.

The disease occurs under all conditions of manurial management, and, as has been indicated above, on old pastures—for example, meadows, policy grounds, and paddocks to which manure is not known ever to have been applied.

It has been suggested that there appears to be some connection between the earliest occurrence of grass sickness in a district and the stage of vegetation which obtains there, because in certain districts in which vegetation is advanced by a period of, say, fourteen days as compared with adjoining districts, the earliest cases in each area occur at a corresponding period. Thus in the district around Aberdeen the disease may be expected to commence to occur in epizootic form at about the fourth week in May, while in the Upper Deeside area its prevalence is not usually experienced until about the second week in June. During the spring and early summer of the season 1941 the weather was remarkably cold and dry, and it was generally agreed that in Aberdeenshire at about the middle of June the vegetation in general had been retarded by about one month. It is therefore interesting to observe that in 1941 the disease became prevalent in these two districts at its accustomed times, and was not apparently influenced either by climatic factors or by the condition of the vegetation. (It is recognised that it is as yet too early to draw any clear inference from this observation.)

Until recently grass sickness was not known to occur in any part of Ireland or on any island around the British coasts. It was, however, observed in Orkney in 1938 and in Northern Ireland in 1941. It has also been noted that relatively few cases apparently occur in the vicinity of industrial areas—for example, the coalfields of South Fife, Ayrshire, and Northumberland.

It is commonly observed that a farm that has been previously free from the disease may have several horses affected in one season, or even in two or three successive seasons, and that thereafter the disease does not occur on that farm for many years. It is also commonly observed that the disease in one particular summer may be very prevalent in a certain district of a veterinary practice, and that in other districts of that particular practice only very few cases are encountered. During the next summer the district that previously had been heavily affected may produce only an occasional case of the disease, while another district and one perhaps widely separated from that other may now become an area of great prevalence.

While in a particular season two or more cases not uncommonly occur on one farm or on immediately adjoining farms, if the affected farms in a grass sickness area be plotted on a map, their distribution will appear to be highly erratic, even eccentric; they are often widely and quite irregularly scattered and there is no evidence, or at least no apparent evidence, of any connection direct or indirect between one outbreak and another; indeed the case occurrences are such that one might *prima facie* attribute them to mere chance. There is, however, little, if any, doubt that these are not chance occurrences, but that there is some fundamental law, as yet very imperfectly understood, which governs their manifestation.

Numerical Incidence.

During the summer months in affected districts the disease assumes an epizootic form, and the incidence varies between 2 per cent and 4 per cent. As has been indicated, only occasional cases occur during the months of winter, although during that season of the year two or more cases not infrequently occur on the same farm at about the same time.

It is very difficult closely to assess the number of cases occurring annually throughout the country. In 1936 grass sickness was particularly severe, and it is estimated that in that year probably 1200 to 1500 horses in Scotland fell victims to the disease.

PART II.

Clinical and Pathological Features.

Symptoms—Acute Type.

The early symptoms are frequently indefinite. The horse may appear somewhat sluggish and depressed, and symptoms of slight abdominal pain may occasionally be shown. Not infrequently one of the earliest signs of illness is that swallowing is performed imperfectly, or at least with difficulty. The attendant often notes that when the horse is watered he may drink apparently normally for several seconds, whereupon he abruptly stops drinking, makes a retching movement accompanied by the forceful discharge of the water from the mouth and nostrils. Food is masticated slowly, but, on attempting to swallow, the animal may choke and the ingesta are forcibly regurgitated. Clinical studies indicate that these symptoms are the result of œsophageal spasm.

Soon the horse assumes an appearance of apathy and dejection, or there may actually develop a condition of somnolence; but he can be immediately roused by a sharp word; thereupon he again soon relapses into a somnolent condition. The pulse is, typically, frequent in rate (60 to 80) and soft in character, and while two or more degrees of pyrexia may be observed the temperature usually is relatively little affected. The bowels are completely inactive; fine muscular tremors appear over the shoulders and flanks, and there is periodic patchy sweating, particularly under the tail, where the sweat may form a soapy, foamy mass. There is, almost invariably, a very considerable reduction in the volume of urine excreted; in peracute cases the animal may micturate only once throughout the course of the illness, and that usually during the prodromal phase of the disease; on autopsy the bladder in the great majority of cases is found to be practically empty. Respiration is usually normal in rate, but may be somewhat laboured and is sometimes accompanied by a soft snoring sound. The appetite is in abeyance; the mental depression is continuous and progressive; regurgitation of fluid, sour-smelling ingesta, or even actual vomiting may occur at intervals.

Salivation is often, periodically, very profuse, but there is some doubt whether an absolute increase in salivary secretion occurs or whether excessive secretion is apparent rather than real, since the salivation observed may result from the accumulation of saliva in the mouth due to difficulty in swallowing and also, perhaps, to some extent to the condition of somnolence that prevails. Certainly no salivation may be evident until the jaws are slightly opened, when the saliva at once drools from the lips.

Throughout the course, which in peracute cases may run from twelve hours to two or three days, general distress is very evident, although there may be little, if any, sign of abdominal pain. It is considered that the distress is in large measure due to the presence of acute gastric distention (further reference to this is made later). There is usually evidence of some degree of tympanites, but this is seldom extreme.

Symptoms—Subacute and Chronic Types.

In the subacute and chronic forms of the disease the prodromal symptoms are similar to those of the acute type, but they are much less intense in their manifestation. The appetite is in abeyance, and the bowel movements are sluggish; there may be some degree of difficulty in swallowing, and the conjunctiva is frequently icteroid. The animal commonly assumes a somewhat huddled posture, with his hindquarters placed against a corner of the enclosure. There is an almost complete absence of thirst; indeed the patient seldom shows any desire to drink water. The abdomen becomes progressively contracted, so that the contour of the body suggests that of the greyhound. The fleshy muscles of the trunk, particularly those of the quarters, become shrunken in appearance, lose their resiliency, and are remarkably 'hard' on palpation.

In subacute cases the course may run from one to three or four weeks, whereas in the chronic type the course may extend into a period of months, after which apparent recovery may occasionally occur. Complete recovery, however, is very rare, and although after a prolonged period of convalescence the animal may exhibit the general appearance of good health, when again returned to work he is quickly found to be useless.

There is a fairly general consensus of opinion that in comparatively recent years the clinical picture of the acute types of the disease has somewhat changed, in that the symptoms of sweating and muscular tremor are not now so marked and may even be absent, and that a larger number of recoveries from the acute attack are now observed.

Autopsy.

In summarising the post-mortem findings in the acute type of grass sickness it may be said that there occur an acute distention of the stomach with fluid, an excessive quantity of fluid in the small bowel, and an acute impaction of the large colon with hard, dry ingesta; but no lesion of any organ has been regularly recorded.

In less acute and chronic types there is no distention of the stomach, and the intestines may be relatively normal in appearance. The spleen, however, is usually somewhat enlarged, but the pulp is firm in consistency; catarrhal inflammation of the mucous membrane of the pharynx has been noted occasionally.

Histological Findings.

Extensive histological investigations carried out over a period of years have failed to determine the regular occurrence of any microscopic lesion.

Biochemical Investigations.

During the past twelve years very extensive biochemical investigations have been carried out both for the purpose of determining changes in the normal constituents of the blood and of tracing the presence of any abnormal nitrogenous or other substance. Fourteen normal blood constituents were examined: these were sugar, inorganic and total phosphorus, hæmoglobin, chlorides, preformed creatinine, amino-nitrogen, non-protein nitrogen, albumin, globulin, fibrin, calcium, magnesium, and potassium. It was found that during the terminal phase of the attack the majority of these constituents tended to rise, with the exception of calcium, magnesium, and potassium, which remained generally within the normal range. In the case of the chloride there was a tendency to fall. From this evidence it may be inferred that the blood picture in the peracute and the acute types of grass sickness resembles that of an anhydræmia. With the exception of this finding, which appears to indicate the essential pathology of the disease, no abnormality has been discovered. Apart from the biochemical investigations, the physical characters of the blood have also been extensively studied. The results go to confirm the biochemical findings that, pathologically considered, grass sickness is an anhydræmia.

PART III.

ÆTIOLOGY.

General Considerations.

The comprehension of the ætiology of grass sickness has proved very difficult, although we are dealing, in at least the majority of cases, with an acute disease running a short, definite, fatal course, exhibiting a well-defined syndrome, occurring in its epizootic form during a relatively short seasonal period, and, with few exceptions, under clearly recognised circumstances—*i.e.*, those of pasturage.

The manner of the occurrence of the disease both in respect of its erratic distribution on different farms within the affected areas and its equally erratic periodicity on the affected farms has constituted a perplexing feature of the problem.

The question whether grass sickness is due to a living infective agent or to a poisonous chemical substance such as might be represented by a plant poison or a toxic metabolite, is one for primary consideration. There is, however, a considerable volume of evidence which might be connoted as indicating that a non-viable factor is the possible cause of grass sickness, and there is also a considerable volume of evidence which could be understood as indicating that it results from a living infective agent.

It is true that there is no clear indication that grass sickness is contagious or infectious in so far that all attempts to effect transmission by the employment of inocula derived from affected cases have proved negative, while the epizootiology affords no evidence of transmission by either immediate or mediate contagion; it is a frequent observation, however, that two or more cases occur on the same farm or on closely adjacent farms at about the same time, and it is also a common experience that an area in which the disease is very prevalent during one particular year may furnish very few cases during the next or subsequent seasons. It has been observed that much the highest incidence occurs in horses of three to six years old, while those of less than one year old are very rarely affected, and the suckling foal appears to be immune. It would seem reasonable to expect that if the cause were an extraneous poisonous substance, then horses of all ages would be equally susceptible, or at most that the degree of susceptibility for the different age groups would vary only within relatively close limits ; on the other hand, it is well known that in many infective diseases, particularly virus diseases, a marked age-susceptibility obtains.

These observations, and the fact that the disease has extended into districts in which it was previously unknown, seem to suggest the possibility that the causal agent is a living *contagium*, although such *contagium* may be one that is unable to remain viable for other than a relatively short period of time when it is not in close contact with the tissues of its host.

The assumption that the causal factor is a living infective agent appears to find some further measure of support in the fact that insular areas such as Ireland, the Scottish Western Isles, and Shetland for a relatively long period have remained free from grass sickness, although there is considerable human traffic between these islands and the mainland, but very little importation of horses by the islands from the mainland. It has been supposed that within these islands (with the exception of Ireland) the horse population is small, and, since the incidence of grass sickness is usually only between 2 per cent and 4 per cent, it has been assumed that for a long period the disease may have occurred in these islands in the form of sporadic cases, and so may have remained unrecognised. This view, however, is definitely difficult to accept, especially when one considers the case of Orkney.

In areas in which the disease for many years has assumed an epizootic character it is very difficult, if not impossible, to attempt an interpretation of the erratic character of its distribution. It is therefore desirable to consider the occurrence of the disease in a hitherto ‘ clear area ’ such as Orkney.

The horse population of Orkney is relatively high, there being some 5300 horses of over one year old, and although the veterinary practitioners in Orkney had had considerable experience of the disease on the mainland of Scotland and were familiar with its clinical features they did not encounter grass sickness there until 1938. In that year three cases on two adjoining farms occurred on the south coast of Pomona (the ‘ mainland ’). In the following year three cases occurred, again on two adjoining farms on the east coast, and in the spring of 1940 three cases occurred on a farm on the west coast of Pomona. It is therefore interesting and probably significant to observe that the first nine cases in Orkney occurred within three very closely confined areas but at widely separate *loci*, and that they were all on farms situated immediately on the coast. In 1940 four other cases of the disease occurred ; all the affected farms were inland, but two were, like the earlier cases, immediately adjacent.

It has been already stated that very few cases of grass sickness recover, but it has been noted that upon occasion a recovered case has again developed the typical disease during the subsequent grazing season. Such instances are, of course, of very rare occurrence; but, on the assumption that the diagnoses were correct, it would appear that if one attack confers immunity, then that is of short duration.

Taking these observations at their face value they might be regarded as suggesting that the cause of the disease is some factor other than an infective agent, although the immunity following several acute infective diseases may be relatively weak in character and of short duration. (In the North Dakota outbreak of equine enzootic encephalomyelitis—a virus disease—it was observed that 255 horses that had recovered from an attack of the disease in 1935 were again affected in 1937.)

In discussing the ætiology of grass sickness it is convenient to consider the several ' disease groups ' to which the condition might possibly be referred, but it is only now, in the light of our accumulated knowledge, that we are able to attempt an assessment of the comparative probabilities for its proper classification into one or other of these groups :—

(1) Plant Poisoning.
(2) Deficiency Disease.
(3) Anaphylaxis.
(4) Digestive Disturbance associated with the Development of Poisonous Products of Intestinal Origin.
(5) Toxic Chemical Substance elaborated in Pasture Plants.
(6) Living Infective Agent: (*a*) Invasive Bacterium; (*b*) Protozoan Parasite; (*c*) Toxin-producing Bacterium; (*d*) Filtrable Virus.

(1) *Plant Poisoning.*—The conditions of occurrence certainly suggest the possibility that the disease may result from the ingestion of a poisonous plant or of a poisonous fungus parasitic upon plants, and, indeed, this was one of the first lines of investigation to be followed. The pastures at Barry Camp at the time of the 1911 epizootic contained large numbers of the common Tormentil (*Potentilla tormentilla*), and in certain shortly subsequent outbreaks in Angus, Alsike Clover (*Trifolium hybridum*) was very prevalent in the pastures on which the cases occurred. Feeding experiments with these plants afforded no indication that they were in any respect poisonous, but systematic botanical surveys of affected pastures were not carried out until the spring of 1927, when, with the collaboration of the Department of Botany, Edinburgh University, systematic surveys of the flora of a limited number of affected fields were made. These inquiries were followed

in the summer of the same year by an extensive survey by the Department of Botany, East of Scotland College of Agriculture, when eighteen affected pastures were carefully examined. This survey (the results of which have been reported by Mr W. A. Pool, under whose general direction the research was then conducted) showed that in the eighteen pastures sixty-one plant species occurred, but of these forty-three were found in less than six of the eighteen fields. In other words, only eighteen plant species occurred in six or more of the pastures, and none of them was present in all the pastures. All these eighteen species in question are well known, and for long have been recognised as of common and general occurrence throughout Britain. The grasses most commonly present were :—

Perennial Ryegrass, 14 fields	77 per cent.
Cocksfoot, 14 fields	77 ,,

and the most common weeds were :—

Self-heal, 16 fields	88 per cent.
Speedwell, 14 fields	77 ,,
Sheep's Sorrel, 11 fields	61 ,,
The Buttercups—	
Ranunculus acris, 9 fields	50 ,,
R. repens, 11 fields	61 ,,

In 1938 there was arranged a further botanical survey, this time in collaboration with the Department of Botany, North of Scotland College of Agriculture. This survey was carried out during the period 31st May to 1st July. The field botanists accompanied members of the Institute staff to farms upon which cases of acute grass sickness had just previously occurred. Information, where possible, was obtained concerning the rotation followed, the age of the pasture, the seed mixtures employed, and the manurial management. Details were also sought in respect of the time the affected animal had been on the pasture previous to the appearance of the disease. In all, seventy-two fields on sixty-three farms were examined, and a list was made of all the plants observed in each field and of those plants surrounding the fields to which the animals had access.

It was incidentally observed that :—

6	fields	consisted of	1	year old pasture.
27	,,	,,	2	,,
26	,,	,,	3	,,
3	,,	,,	4	,,
3	,,	,,	5	,,
2	,,	,,	6	,,
5	,,	,,		permanent pasture.

It will be noted that the great majority of the pastures concerned were two and three years old. It may be reasonably assumed, however, that the large majority of horses at pasture in the affected areas are grazed upon second and third year old grass, and since the actual number of horses grazed on the different ages of pasture is unknown it is recognised that little, if any, significance can be attached to the figures. It may be noted in passing, however, that five fields (7 per cent) consisted of permanent pasture. The greater number of the fields were undergrazed, but the 'pasture bulk' showed considerable variation, and in a number of cases the herbage could be described as sparse.

It has long been recognised that grass sickness frequently occurs on fields containing Wild White Clover, and the following observations were made :—

Percentage Wild White Clover in Herbage.	Number of affected Fields.
50-75 per cent	40
25-50 „	16
10-25 „	9
Under 10 „	8

Wild white clover is, however, usually very prevalent on two, three, and four year old pasture on which the great majority of horses are grazed; it is commonly absent or at most very sparse in permanent pastures.

As already mentioned, it was found that in the previous extended survey perennial ryegrass and cocksfoot were the most common grasses present. In the 1938 survey it was also noted that perennial ryegrass was a very frequent constituent of the herbage, but that it also presented wide variation in its incidence. In four fields it represented less than 4 per cent of the pasture, and in three other fields it was either absent or occurred in such small quantity that it was overlooked.

Cocksfoot (which some observers have associated with the disease) appeared to be entirely absent in twelve of the seventy-two fields. Indeed, no pasture or weed plant was found to be regularly present in the pastures examined, although the Creeping Buttercup (*Ranunculus repens*) was present in all but one. None of the grasses was found to be ergotised. Moulds were frequently present at the bottom of the herbage, especially where the cover was good, and the Clover Leaf Spot (*Pseudo-peziza trifolii*) was, as might be expected, almost uniformly present on wild white clover.

Samples of the moulds referred to were collected, and were identified by the Department of Plant Pathology, East Craigs, as a *Basidio-mycete mycelium*, a *Rhizopus* sp., a species of Mucoraceæ, and a (?) *Phoma* sp. Cultures of these were prepared and later administered to experimental horses, with negative result.

In numerous instances plants from affected pastures were gathered and fed in quantity to experimental horses, with negative result. These plants included: Speedwell (*Veronica serpyllifolia*), *Prunus* sp., Ragwort (*Senecio Jacobœa*), Self-heal (*Prunella vulgaris*), Corn Spurrey (*Spergula arvensis*), Alsike Clover (*Trifolium hybridum*), Charlock (*Brassica arvensis*), Yarrow (*Achillea millefolium*), Bindweed (*Polygonum convolvulus*). Wild White Clover (*Trifolium repens sylvestre*), Hemlock (*Conium maculatum*), Fool's Parsley (*Chœrophyllum sylvestre*), Bishop's Weed (*Ægopodium podograris*), were administered in large quantity by stomach tube. With the exception of a horse to which *Conium maculatum* was given, and in which symptoms of coniine poisoning developed and rapidly passed off, no ill effects followed the feeding of any of these plants.

It is recognised that if grass sickness were due to the ingestion of a poisonous plant, the noxious substance concerned must either be of an extremely potent character or else it must be predicated that a very large quantity of the plant would require to be ingested, since so large an animal as the horse may become fatally ill and so die after only a short grazing period.

Since there is no evidence in the affected pastures of the presence of any plant recognised as being even slightly toxic, it is believed that the conclusion that grass sickness is not caused by a plant which is known by repute to be poisonous may quite properly be drawn.

(2) *Deficiency Disease.*—It has been suggested that grass sickness may result from a dietary deficiency, since horses are usually attacked shortly after they have passed through the most trying period of the year, during which they have been put to hard work and have been receiving only dry fodder—*i.e.*, oats and hay, as distinct from being allowed to graze naturally. Many horses, however, are affected with grass sickness after they have been grazing continuously for several weeks on natural pasture, and the disease does not occur, or at most only extremely rarely occurs, in horses that have been stabled for prolonged periods. It may here be recorded that in 1938 (in continuation of a preliminary investigation carried out in 1936) the livers of thirty-three normal horses—*i.e.*, normal in that they did not suffer from grass sickness or any liver affection—and the livers obtained from fifty-eight cases of acute grass sickness were examined for their content of vitamin A. It was found that there was no significant difference between the two groups.

The history, the symptom-complex, and the short fatal course in the acute type of grass sickness fail to furnish any indication that the disease represents a mineral or a vitamin deficiency. It is therefore believed that this hypothesis may quite safely be discarded.

(3) *Anaphylaxis.*—The idea that the disease represents a form of anaphylactic shock has attracted considerable attention.

It could be postulated that at some period after being turned out to grass the horse might become sensitised to some foreign protein, and that after an appropriate interval he might receive a quantity of the specific protein to which he had become sensitive. It has already been indicated that in our observations the majority of cases occur after the horse has been at grass for at least a fortnight, during which period a condition of anaphylactic sensitivity could, of course, develop. Other observations (although these are limited in number) go to show that the disease often occurs shortly after the horse has been moved from one pasture to another when, conceivably, the specific protein concerned had become accessible. The fact, too, that in anaphylactic animals only a minute quantity of the specific protein to which they have become sensitive is required to determine shock could explain why so large an animal as the horse can so quickly contract a fatal malady on pasture which is in every respect apparently perfectly wholesome. It also might help to explain why the disease is peculiar to the horse, since it is known that certain animal species are anaphylactic only to certain proteins (*e.g.*, hay fever in man).

Difficulties in the acceptance of this theory arise, however, when one considers that cases of grass sickness do occur in horses which have been put out to grass for a period of only a few days, that is before the lapse of the minimum period requisite for the development of the anaphylactic state. (It might be argued, of course, that a specific sensitivity had developed before the horse was put to grass, but when one considers that his diet then consists of oats, maize, bran, and hay, or more usually only of oats and hay, such an argument becomes very difficult to accept.) Anaphylaxis in all animals is quickly followed either by death or by rapid and complete recovery; in the case of grass sickness, on the contrary, chronic cases run a long course of lingering illness, and recovery, when it occurs, is very seldom complete. There is the further difficulty of forming a conception of the nature of the hypothetical protein and of the manner in which it could have been introduced into the affected pastures other than by the introduction of a plant. There is, however (as has been already indicated), no evidence of any new plant having been introduced into the grass sickness areas, all the flora in the affected fields being those which for a long time have been recognised as of common occurrence everywhere; while the seed mixtures used in the affected areas are purchased from wholesale merchants, through whom their distribution is widespread throughout the country.

It is well known that although the symptoms of anaphylactic and anaphylactoid shock present very considerable differences in different species of animals, the anaphylactic symptom-complex in any given species is always the same no matter what protein or other substance is concerned in its production.

Experimental anaphylactic shock in the horse has been investigated by Professor de Burgh Daly of Edinburgh (unpublished observations), who found that the outstanding symptoms are diarrhœa, generalised and profuse sweating, inability to maintain equilibrium, and violent convulsive attacks. In acute grass sickness there is extreme constipation; general convulsions do not occur, and the equilibrium is unaffected; indeed, the horse usually remains standing until almost immediately before death.

The balance of evidence seems, therefore, to be definitely against the theory of anaphylaxis.

(4) *Poisonous Products of Intestinal Origin.*—It has been postulated that the disease might arise from the absorption of toxic products elaborated as the result of the inactivity of the bowels. There appear, however, to be a number of cogent objections to the acceptance of this hypothesis. The alimentary tract as a whole becomes paretic at a very early stage in the clinical course; this is evidenced by the patient's showing inability or at least difficulty in swallowing and by regurgitation (which results from the stomach's being markedly distended with semi-fluid ingesta), by the absence of borborygmi, and by the non-passage of fæces; typically, these symptoms may be observed during even the early prodromal phase of general malaise. It appears evident, therefore, that the impaction of the colon is not the cause of the disease, but that it is rather a manifestation of its effects. Cases of simple subacute obturation of the large colon are of common occurrence in the horse; in this condition few or no fæces may be passed for several days, and although general malaise and depression are very evident, the syndrome of grass sickness has never been recorded as a sequela.

It has also been suggested that because of the somewhat abrupt change from a diet of oats and hay to one of succulent pasture digestive disturbance occurs, and that this results in the production of toxic substances. The practice of suddenly changing the diet of the horse from dry fodder to luscious pasture is, of course, a very old, albeit a bad one, and it has long been recognised that, upon occasion, it may be associated with digestive disorders accompanied by diarrhœa and slight colicky pains. This condition, however, is rarely of a serious nature and has never been recognised as the precursor of grass sickness.

It is also to be remembered that the procedure of turning horses out to grass in the summer months has been practised all over the country from time immemorial, while grass sickness, at least in its epizootic form, has been prevalent only in comparatively recent years and also in relatively limited areas.

It is therefore considered that the theory that refers the cause of the disease to the elaboration of poisonous products of intestinal origin has no basis either in circumstantial or other evidence.

(5) *Toxic Chemical Substance Developed in Pasture.*—It already has been observed that there is no evidence of the presence in affected pastures of any plant known to possess toxic properties. It has been postulated, nevertheless, that the disease may, in fact, arise from a poisonous chemical substance on the assumption that because of some change in grassland management some aberration in the physiology of ordinary pasture plants has occurred, and that as a result they now have developed in their tissues a new substance possessing highly poisonous properties.

This theory requires as a condition to its acceptance that within the affected areas there has, in fact, occurred some change in grassland management since, say, 1911. It has been stated that since about 1918, as a result of the use of improved seed mixtures which include wild white clover, and also because of the more extended application of nitrogenous manures in Aberdeenshire and the adjoining counties, the protein content of pastures has been very largely increased. It has therefore been suggested that at periods of rapid growth of pasture, when the disease is most prevalent (June), it is possible that protein synthesis may not take place normally or completely, thus giving rise to toxic pre-protein substances such as peptones or proteins of abnormal amino-acid composition.

This hypothesis appeared in several respects to be an attractive one, and for some years it has been followed by a systematic chemical investigation which has as its object the assaying of the important nitrogenous constituents of pasture such as nitrates, glutamine, asparagine, free ammonia, and total non-protein nitrogen. This, it is hoped, will indicate whether there is any abnormality in so far as the nitrogenous composition of the grass is concerned. There is also being carried out an extensive amino-acid analysis of the plant proteins.

The hypothesis, nevertheless, raises a number of ponderable difficulties. Reference has been made to the wide divergence in the types of pasture on which grass sickness commonly occurs; indeed, every type of pasture from lush three-year-old grass to poor heathland has been represented in the affected grazings.

Through the collaboration of the Macaulay Institute for Soil Research, a comprehensive examination of two hundred and sixteen representative samples of the soil of seventy-two affected fields has been carried out. The examination had as its object the characterising of the soils as fully as possible; this included the determination of readily soluble and insoluble plant food materials, exchangeable bases, mechanical composition, acidity conditions, carbon-nitrogen relationship, and the quantitative presence of trace elements.

It can, briefly, be said that the soils under examination showed in every respect very wide variations.

Grass samples were also obtained from seventy-one affected fields, each within a few days of an occurrence of the disease. The samples were made as representative as possible of each field. The following constituents were estimated: crude protein, crude fibre, ether extract, total ash, nitrogen free extract, calcium, magnesium, phosphate, potassium, and sodium. Trace elements were also quantitatively determined. It was found that in respect of each constituent the results presented a wide variation ranging from that of comparatively poor grass for the time of the year (June) to that of a succulent and rich-type pasture.

From these experimental findings, which confirm both the results of the botanical surveys and the definite inferences drawn from our own general observations, it appears obvious that there exists no correlation between the type of pasture concerned and the occurrence of the disease.

To assume that a toxic chemical substance is elaborated in high concentration in otherwise wholesome pasture plants predicates that such a substance is elaborated in highest concentration in June when the disease is most prevalent. It is true that at this time grass contains a high proportion of protein, that its fibre is in a very digestible condition, and that its mineral content is well balanced; but the hypothetical toxin must necessarily exist in stupendously high concentration since there is little, if any, evidence of its being a cumulative poison (because horses may be attacked after having been turned out to grass for only a few days); further, the pasture is not infrequently sparse, and it has been quite commonly observed that the only access an affected horse has had to grass was an occasional bite at the headrigg or the roadside. It has been further observed, although only very occasionally, that the affected animal had not had any access to cut or to growing grass for several years. It is to be remembered also that colts which have had access to sparse pasture (for only a few hours on occasional days) in winter and early spring are not uncommonly attacked, and that old permanent turf composed only of fine grasses to which no manurial treatment has been applied within living memory also commonly provides cases.

To meet these difficulties it has been suggested that the poisonous substance may persist in hay. Throughout the whole history of the grass sickness investigation no suspicion has been attached to hay. It has always been a common practice to feed grass freshly cut from pastures in the adjacent rural district to horses stabled in the towns situated within the areas of prevalence, including the cities of Aberdeen and Dundee. During the last twenty years grass sickness has been prevalent in the eastern counties of Scotland, and although (at a moderate estimate) during each year of this period several thousands of horses have been stabled in the towns in these areas the disease has appeared in town horses only upon very rare occasions as an odd and remarkable rarity (p. 4).

It is also true that seed mixtures similar to those used in the affected areas are largely employed, and that nitrogenous and other manures are commonly applied in districts in which the disease is seldom, if ever, known to occur; it may therefore be reasonably assumed that the protein content of the pastures in these non-affected areas has also been considerably increased by such measures. It is also to be remembered that the disease has extended in epizootic form into new areas in which no obvious change in grassland management is known ever to have been made.

It has been postulated that a horse may eat any amount up to 30 lb. (dry matter) of pasture each day, and that since this may contain 30 per cent protein it is conceivable that this quantity might contain one or two grammes of a toxic nitrogenous substance. To ingest 30 lb. dry matter a horse would require to eat a quantity of from 120 to 150 lb. of grass. This is a very considerable amount, and is much more than could possibly be ingested each day by even a large heavy draught horse when grazed on scanty pasture; it is also very difficult to understand how even one or two grammes of a highly toxic chemical substance could be quickly elaborated on poor sparse pasture or on closely grazed old permanent turf.

Analyses have been made of affected pasture for the detection of special substances such as icterogenin, cyanide, and oxalate. No substance resembling icterogenin has been isolated, and the values for cyanide ranged from 0·001 per cent to 0·003 per cent—quantities very far below those requisite to produce toxic effects. Many of the samples possessed a high oxalate content, especially in the case of those from acid soils on which sheep's sorrel was abundant. Icterogenin (3½ lb. of the bark and leaves of *L. rehmannii*) and also cyanide and oxalic acid in poisonous quantities have been administered to experimental horses without their producing any condition even remotely resembling that of grass sickness

The hypothesis that the causal agent of grass sickness is a poisonous chemical substance elaborated in ordinary pasture plants as the result of an aberration in their metabolism, which, in turn, has been effected by a comparatively recent change in grassland management consisting in the application of artificial manures and the introduction of new seed mixtures, is one that is now very difficult of acceptance.

(6) *Living Infective Agent*—

(*a*) Invasive Bacterium;
(*b*) Protozoan Parasite;
(*c*) Toxin-producing Bacterium;
(*d*) Filtrable Virus.

(*a*) *Invasive Bacterium.*—At an early stage of the investigations Gaiger (1922) isolated from the central nervous system of an acute case of grass sickness a diplo-streptococcus similar to that which, at that time, was regarded as ætiologically associated with Borna disease. The organism was found to be pathogenic to rabbits and sheep when inoculated by certain routes, but horses when inoculated intracranially, subcutaneously, or intravenously remained normal. It was later concluded that this organism was without ætiological significance in grass sickness.

Numerous attempts to cultivate an organism from the blood of acutely affected horses have proved negative; it is believed that on this evidence alone it may be safely inferred that the blood in acute grass sickness contains no pathogenic invasive bacterium.

The peritoneal fluid in the majority of cases has proved to be bacteriologically sterile; such organisms as have been isolated by cultural methods may be regarded as of extraneous origin. No organism pathogenic for laboratory animals has been isolated from the liver, which in several cases appeared to be completely sterile; in the majority of cases no bacterial culture could be obtained from the spleen.

Tocher claimed to have isolated *Clostridium botulinum* from the spleen in cases of grass sickness, but the evidence submitted has failed to find acceptance. (Further reference to this matter appears at p. 22.)

Throughout the course of the investigations many attempts were made to transmit the disease experimentally to healthy horses and to laboratory animals. The material employed was derived from acute cases of the disease, and comprised a large number of inocula representing diverse types of tissues and fluids which were inoculated by various routes. These experiments included the actual transfusion of large quantities of blood from affected to healthy horses. The results of all this work have been consistently negative.

(*b*) *Protozoan Parasite.*—In all the several extensive microscopical examinations of blood and other tissues that have been made, no protozoa have been demonstrated. This in itself renders it unlikely that a protozoan parasite is the causal factor.

Reference has been made to the consistently negative results that have followed all attempts to transmit the disease by the inoculation of material, including blood, derived from cases of acute grass sickness, but such failures to effect transmission do not necessarily eliminate a protozoan parasite as the causal factor, because it is, of course, conceivable that the infective stage of a pathogenic protozoan may be reached only after a period of cyclic development within the body of an insect or an arachnid host; this would imply the existence of a living vector. It is true that grass sickness occurs in its epizootic form during the warm months of summer when blood-sucking insects are most active; but low temperatures which cause the almost complete disappearance of free-living flies do not necessarily prevent the occurrence of grass sickness, because sporadic cases and also low-grade epizootics of the disease do occur even in the depth of winter. The only blood-sucking insects known to be parasitic upon the horse, which are prevalent generally throughout the affected areas during the month of June, are *Stomoxys calcitrans* and *Hæmatopota pluvialis* (see also p. 25). Obligate ecto-parasites such as the mange mites and lice, which, when in contact with their host, are capable of withstanding relatively low atmospheric temperatures, are of only very rare occurrence on horses affected with grass sickness. It is also recognised that the symptom-complex of the disease bears no resemblance to any of those diseases associated with protozoal infections.

The evidence therefore appears to be opposed to a protozoan parasite as the causal agent of grass sickness.

(*c*) *Toxin-producing Bacterium.*—Tocher (1923) stated, as his opinion, that the spleen in cases of grass sickness was not sterile; indeed, he believed it to contain *Clostridium botulinum*, which apparently multiplied in the tissues of the affected animal and there produced its toxin. No other worker has confirmed this opinion, and available evidence seems directly opposed to its acceptance.

Cl. botulinum is universally regarded as a toxicogenic saprophyte which produces its toxin in a protein medium of animal or vegetable origin (particularly sausage and other specially prepared meats). The micro-organism is understood to be incapable of undergoing a vegetative phase of existence, or of producing toxin, in the tissues of a living animal. In cases of the condition known as botulism, which relatively rarely occurs in the human subject, the disease is known to be contracted by the ingestion of foodstuffs which have been contaminated by *Cl. botulinum* and which contain its preformed toxin.

It is conceivable, of course, that a preformed toxin such as that of *Cl. botulinum* may be deposited upon pasture, but such a conception is a very difficult one.

In a series of experiments botulinus toxin, Type B., was administered by stomach tube to a number of horses; this resulted in the production of acute botulism, the symptom-complex of which was found to be quite characteristic, but to bear no resemblance to that of grass sickness.

During the field investigation of 1933 a search was made for the presence of bacterial toxins in the intestinal contents of horses affected with acute grass sickness. It was found that the toxin of *Clostridium welchii*, Type D., occurred in a small proportion of the acute cases examined, and it was considered that there was some evidence which permitted the assumption that the earlier the gut was examined after the onset of the attack the greater was the likelihood of detecting the presence of this toxin. During the subsequent years 1934, 1935, and 1936 the same toxin was detected in a proportion of acute cases.

All attempts to reproduce the typical symptom-complex of the disease by administering the toxin of *Cl. welchii*, Type D., to experimental horses (about thirty in number) by various routes and in varying doses proved negative, but in view of the above findings it was determined to undertake (in 1937) an extensive, controlled field experiment wherein approximately 1000 horses would be vaccinated and so rendered actively immune to welch toxin, Type D., and a similar number of horses belonging to the same farms as the vaccinated animals would be kept under observation as controls. It was argued that if a satisfactory degree of immunity could be obtained, and that if this effected a statistically significant reduction in the grass sickness incidence, then it could be reasonably inferred that welch toxin, Type D., was intimately concerned in the ætiology of the disease.

In the case of so large a controlled field experiment the extent of the work involved cannot here be adequately discussed. It may be said, however, that eventually it was arranged that 938 horses should be vaccinated, and that 1451 horses should serve as controls. The farms to which these horses belonged were situated in an extensive area comprising the Counties of Fife, Angus, Kincardine, Perth, and Aberdeen. A vaccine of high immunising quality was evolved, and in the field three vaccinations were performed at intervals of a fortnight. During the course of the experiment blood samples were collected before each vaccination, and again ten days after the last vaccination for the purpose of determining the degree of immunity produced. This involved approximately 4500 tests. Finally, it was found that although vaccination against *Cl. welchii*, Type D., afforded adequate protection against the toxin of that organism, it produced no immunity to grass sickness. It may, therefore, be concluded from this result that grass sickness cannot be referred to the effects of *Cl. welchii*, Type D., toxin.

In considering the various types of evidence obtained by extensive investigation, it may be inferred that there is none that implicates a bacterial toxin as the cause of grass sickness.

(*d*) *Filtrable Virus.*—The remaining possible cause that falls to be discussed is a filtrable virus.

On a close examination of all the evidence there appears to be no fundamental objection to the assumption that grass sickness is due to an infective virus, except in so far as that the epizootiology of the disease renders it very difficult to understand how such an infective agent can be transmitted in nature.

Because of the regular character of the symptom-complex, and the fact that recovery is rarely if ever complete, it is generally accepted that the symptoms arise from nerve damage, which is irreparable and therefore permanent. If a virus be the cause it may therefore be permissible to postulate that it is neurotropic in character.

As against this view it has been pointed out that no lesion of the central nervous system has been determined. This, perhaps, is not entirely unexpected, since the symptoms are not referable to central involvement.

It has also been contended that an acute virus infection might be expected to produce marked systemic disturbance in which pyrexia would be prominent as a symptom. Although severe systemic disturbance is evident in acute grass sickness, only a slight and apparently irregular febrile condition is observed. This, however, does not constitute a serious objection to the possibility of virus infection.

On the assumption that a virus is the causal factor, it is considered possible that it may be transmitted in one or more of the following ways :—

Transmission by—

(*a*) A living vector (*e.g.*, bird, mammal, or insect) ;
(*b*) Ingestion ;
(*c*) Direct contact, or by droplet infection ;
(*d*) Fomites (substances capable of transmitting contagium).

(*a*) *Living Vector.*—Because of the nature of the extensions of the disease—*e.g.*, up river valleys and along lines of farms situated near the coast, &c., it was thought possible that if a living infective agent were the cause it might be carried by a vector—a wild mammal, a bird, or an insect. Such a vector would require to conform to certain conditions, and these appeared to be met by an unwinged but motile insect, *Smynthurus viridis*, one of the *Collembola*. This insect is ubiquitous, but there are certain areas in which it finds its optimum conditions, and these areas conform remarkably closely to those in which grass sickness occurs in its epizootic form. The insect has also increased since the practice of sowing wild white clover, upon which it feeds, became common (*circa*, 1910), about which time grass sickness is known to have become epizootic.

During the seasons 1930, 1931, and 1932 seventy fields upon which cases of grass sickness had just previously occurred were systematically swept; it was found that the sweepings contained (besides vegetable debris) a large number of insects, and that *Smynthurus* was common to all the gatherings. The sweepings were administered to thirty-six horses, principally by stomach tube, but also by nasal insufflation, and extracts from the sweepings were inoculated intravenously and subcutaneously; the results of all these experiments were negative.

It has been already mentioned (p. 22) that the only blood-sucking parasites known to attack the horse throughout the affected districts in the month of June are the flies, *Stomoxys calcitrans* and *Hœmatopota pluvialis*. Other blood-sucking flies are largely limited to certain localities—for example, *Tabanus* spp. (the horse-flies) and *Chrysops relicta* (the deer-fly) are found mostly in hilly districts—*e.g.*, around the Cairngorms—and are of relatively rare occurrence in lowland areas. *Culicoides pulicaris* (the midge) and *Simulium reptans* (the black fly) are found, respectively, only near marshy districts and near fast-running streams. As has also been mentioned, obligatory ecto-parasites of the horse such as lice and chorioptic mites have been found on only very rare occasions in cases of grass sickness. The fact that the disease occurs in mid-winter (in colts at pasture) when biting flies are quite inactive is to be remembered, and in view of the further fact that blood-sucking insects are capable of taking up only a minute quantity of blood, and that the blood of grass sickness cases appears to be non-infective even when it is injected or transfused in large quantity into experimental horses, render the association of a blood-sucking insect vector (other than as a carrier of the infective phase of a protozoan parasite) a remote one.

The possibility of birds or wild mammals acting as vectors must be considered. Reference has been made (p. 2) to evidence which appears to render it unlikely that birds are concerned in the transmission of the disease; but while at present no direct evidence pointing to the incrimination of a mammal can be adduced, it is quite conceivable that a wild mammal—*e.g.*, a rodent—could act as a vector or even be a reservoir of infection.

(*b*) *Ingestion.*—That a hypothetical virus is capable of causing infection after its ingestion by a horse is possible, but perhaps rather improbable, although it is conceivable that it might gain entrance to the body through the pharyngeal mucosa, and it is true that there has been obtained some evidence which suggests that certain virus diseases may be contracted by the ingestion of food contaminated with their specific virus.

(*c*) *Direct Contact and Droplet Infection.*—Since it frequently occurs that two or more horses which have been in immediate contact with each other on the same farm contract the disease at about the same time, it is conceivable that transmission in these cases is effected by direct contact or by droplet infection, in which latter case the method of actual infection may have been that of absorption through the intact nasopharyngeal mucous membrane or by way of the olfactory nerve endings. Such method of infection is believed to occur in a number of virus diseases; *prima facie*, however, it would appear that the transmission of grass sickness may occur by means other than by direct or by droplet infection, since, as has been said already, the disease occurs in sporadic cases on farms situated several miles apart from each other, and close inquiry fails to reveal any direct or indirect connection between these. It is to be remembered, too, that horses at grass are virtually isolated on their respective farms, and that they are usually in relatively meagre direct contact with human agents.

(*d*) *Fomites.*—From what has been said it will be realised that there appears to be an entire lack of evidence of any inert substance which could act as a means of disseminating contagium.

The difficulty of maintaining a hypothesis for virus infection by reasoned argument would thus seem to be an insuperable one if it were not for the fact that at least one virus disease—anterior poliomyelitis of man—behaves, in several respects, epidemiologically, in a manner very similar to grass sickness. It is, of course, clearly recognised that the pathology of anterior poliomyelitis is quite distinct from that of grass sickness, but their epidemiological features offer a very interesting comparison. For example, anterior poliomyelitis may manifest itself in an epidemic area in a very erratic manner, individual cases occurring eccentrically at different *loci* in the area without there being any obvious connection between the cases, although often they all occur at about the same time.

In anterior poliomyelitis the epidemic prevalence is extremely irregular; if, for instance, a community is affected in one particular year it often remains relatively free for a number of years thereafter, but the occurrence of an epidemic in an area may be followed in some shortly subsequent year by the occurrence of another epidemic—not in the previously affected centres, but in their immediate neighbourhood. It is, of course, conceivable that the virus of poliomyelitis may be extensively spread in an epidemic area, and that although a large number of individuals may receive infection, only relatively few manifest the disease.

Anterior poliomyelitis is principally a disease of summer and early autumn, although sporadic cases and even epidemics occur throughout the year and may extend into periods of frost. The influence of season on the incidence of certain virus diseases is quite well known; it is also recognised in encephalitis lethargica, which is generally believed to be caused by a virus, although its ætiology has not yet been precisely determined. Borna disease of horses has a definite seasonal periodicity, epizootics generally occurring in May, reaching their peak in mid-summer, then giving way to sporadic cases during the winter months. Equine enzootic encephalomyelitis has a more closely limited seasonal incidence, its greatest period of prevalence extending from July to November. In this deasease, however, the blood is infective, and it has been shown by experiment that infection can be transmitted by mosquitoes (*Aëdes ægypti*), and although such transmission does not fully explain all the epizootiological features of the disease, the short seasonal incidence may, at least in part, be governed by climatic factors limiting the activities of these insects.

It is recognised that in many virus diseases the factor of age influences both the incidence and the severity of attack. In at least the former respect the prevalence of grass sickness in horses of from three to six years of age is of distinct interest.

From the considerations discussed above there appears to be proper reason for excluding grass sickness from each of the disease groups, with the exception of that of virus disease, into which it might fall if only by a process of elimination of other possibles. There would appear to be, in fact, no grounds of objection to the assumption that its cause is a virus, except that its mode of transmission is very difficult to conceive. This same difficulty, however, obtains in the case of anterior poliomyelitis, which, although known to be caused by a filtrable virus, is transmitted by means that are very imperfectly understood.

It is not possible in a general review of this kind to refer by name to those who have assisted in this research, but it can be said that the Animal Diseases Research Association has had the collaboration of numerous veterinary practitioners, farmers, and research workers both at home and abroad. For this assistance, so willingly and readily given, the Association is grateful.

FARM TAXATION AND FARMERS' ACCOUNTS.

By E. A. BELL, M.A., B.Sc.(Agr.), Farm Accountant, Ayr.

INCOME Tax was first imposed by Sir Robert Peel in 1842—at 7d. in the £. In the intervening years there have been many changes in rates and methods of assessment, but it is noteworthy that from the beginning the profits arising from the occupation of land have always been treated exceptionally. Income Tax is charged under what are known as Schedules, each having its own special rules, and a separate Schedule—Schedule B.—was devoted to the profits of farming. The basis of charge adopted under that Schedule has always been an artificial or conventional one. Although the statutory taxable income on business profits—Schedule D.—is to some extent an artificial creation it has invariably been related to actual profits, but the statutory income from the occupation of land, on the other hand, has not until now been related in any way to actual profit but to the annual rental value of the land occupied. In the early years the plan adopted was to assess the farmer on the rental value of his land, but to charge the duty on that assessment at a fraction of the normal rate of tax. Later, this method was reversed, and the normal rate of tax was imposed on a fraction of the annual rental value. But in either case the underlying theory, which has been maintained for ninety-nine years, was that there was some co-relation between the rental value of the land occupied and the farmer's profit.

From 1896 to 1915 tax was charged on one-third of the rental value of the land. In 1915, owing to the growing prosperity of agriculture and the necessity for increased revenue, the full annual value was substituted for the one-third previously assessed, and in 1918 this was further increased to twice the annual value. In 1922 the basis was again reduced to once the annual rent. A Royal Commission on Income Tax, reporting in 1920, recommended the abolition of this system and the transfer of farmers' liability to actual profits, and suggested that a beginning should be made by transferring the assessments on persons occupying farms exceeding £300 in annual value, farms used for producing special crops, and farms used for the breeding of pedigree stock, leaving smaller farms and other forms of non-specialised agricultural enterprise to be transferred as soon as possible. The Finance Act, 1941, put the first part of this recommendation into effect. Farms exceeding £300 in annual value were, by that Act, transferred to assessment on profits. It can be assumed that a material influence in the delay of twenty-one years in carrying out the recommendation of this Royal Commission was that the extra administrative work and expense involved to the Inland Revenue by the transfer would, owing to the comparative depression of the farming industry, have been incommensurate with the revenue to be obtained thereby. The eventual transfer, however, from the rental basis to profits was a part of the Government's price policy in the present war. The Minister of Agriculture, Mr Hudson, in a broadcast announcement in the autumn of 1940 regarding increased prices of agricultural products for 1941, observed that the Government, in fixing relatively high prices for most agricultural products, had done so for the specific purpose of encouraging crop production on the poorer lands, and that in consequence the prices so fixed would give to the holders of the better lands a higher profit than might, under other circumstances, have appeared necessary. He coupled this announcement of prices, therefore, with the intimation that the Government proposed to withdraw from the occupiers of the better 'parcels' of land the privilege heretofore enjoyed of being taxed upon the statutory assumption that their profits were equal to their rental. The co-relation of prices to encourage marginal production and the new taxation is therefore apparent.

The imposition of taxes upon the actual profits from the occupation of land as distinct from the conventional profits under Schedule B. did not, however, start with the imposition of Income Tax in the 1941 Finance Act. In the search for revenue to meet increasing national expenditure the Chancellor of the Exchequer imposed, as from 1st April 1937, a special tax called National Defence Contribution on the profits of all industry, and the profits of farming were not excluded from the operation of that tax. Its incidence on farming profits, however, was small, as it was chargeable only on profits over £2000, and the proportion of farmers becoming liable to it was therefore infinitesimal. But as from 1st April 1939 there came into effect a special war tax known as Excess Profits Tax, to which in a period of much increased profits many farmers became liable. Notwithstanding the fact that Income Tax in the period from 1st April 1937 was exigible on the statutory profits under Schedule B. assessed on rental, both National Defence Contribution and, from 1st April 1939, Excess Profits Tax were in that period chargeable upon the actual profits as disclosed by a farmer's accounts. And even now those individuals and partnerships who occupy farms of a total rental value not exceeding £300 may be called upon, notwithstanding that their Income Tax assessment is based upon a statutory figure, to prove that their profits are not such as to render them liable to these special war taxes. This difference is even more drastic than it appears at first sight, for it means that liability to taxation exists even although no accounts have been asked for by the Inland Revenue. It means that in many cases accounts may not be demanded until an accumulation of invested money becomes obvious in the tax return, and that then accounts back to 1939 or even 1937 may be required to resist excessive demands. The importance of preserving an accurate record of farming transactions will therefore be clear.

National Defence Contribution.

The first of these special taxes to be imposed—National Defence Contribution—is a tax on profits of over £2000 a year made by any individual or company. It is levied in the case of individuals or partnerships at 4 per cent on the profit in excess of that sum and at 5 per cent in the case of companies. As, however, National Defence Contribution and Excess Profits Tax are not both chargeable in one year on one business—the highest tax only being payable—this tax is largely inoperative, as far as farming is concerned, after 1st April 1939, since the increased profitability during the war period has resulted in most farmers having greater liability for Excess Profits Tax than for National Defence Contribution. The only important period, therefore, so far as farmers' liability to National Defence Contribution is concerned, is that falling between 1st April 1937 and 1st April 1939. Considerable liability to this tax has recently been discovered by the Inland Revenue when accounts for that period have been submitted in connection with the adjustment of liability to Excess Profits Tax.

Excess Profits Tax.

The provisions regarding Excess Profits Tax are much more complex than those pertaining to National Defence Contribution. Broadly speaking, Excess Profits Tax is levied on any profits made since 1st April 1939 which are in excess of what is termed a 'pre-war standard.' Tax was originally charged at 60 per cent on this excess, but it has now been increased to 100 per cent. This pre-war standard is determined by the actual profits of the calendar year 1935 or the calendar year 1936, or the average of the calendar years 1935 and 1937, or the average of the calendar years 1936 and 1937. In comparing the profits of the pre-war standard with those of the taxable period, adjustments are made for additional or reduced capital employed in the business in the two periods. For the purpose of this tax the ownership and occupation of land are treated as one business, whilst for Income Tax the profits on occupation and on ownership are assessed separately under different schedules. The capital represented by the ownership of land is in such case included as part of the capital of the business. In the case of the great majority of farms, however, the pre-war standard is either small or cannot, owing to the absence of records, be properly determined, and in such cases what is called a 'minimum standard' is substituted for the actual profit of the standard years. This minimum standard is £1000 for any business or £1500 for each 'working proprietor.' A working proprietor is defined in the Acts as a person who has, during more than half the chargeable accounting period, worked full time in the actual management or conduct of the trade or business, and the figure of minimum standard usually effective in farm cases is therefore £1500. In order to give relief in cases where the standard is so low that it would not be just to charge this tax on the excess, the Commissioners are given discretionary power to increase the standard in appropriate cases, and this discretionary power is extremely important in view of the comparative depression of the agricultural industry during the years selected for the determination of standard profit. Under Section 31 of the Finance Act, 1940, the Commissioners may increase the minimum standard to a maximum of £2500 in respect of each working proprietor. The number of working proprietors in respect of which this relief can be granted is limited to a maximum of four. In practice this additional allowance is usually granted concessionally at the rate of 6 per cent on the capital in excess of £5000 per working proprietor. Under Section 27 the Commissioners are given power to substitute for the profits standard such amount as they think just, up to a maximum of 8 per cent on the capital of an individual or partnership or 6 per cent on the capital of a company or body corporate. The amount of profit left to an individual farmer whose profits in the standard period were small, after payment of Excess Profits Tax and after allowing for the maximum relief usually granted under these two sections, is shown graphically in Diagram A. (appended).

INCOME TAX.

For Income Tax the transfer of agriculture to assessment on actual profits under Schedule D. is made in the Finance Act, 1941, and the terms under which this change was made are important. It is there enacted that the whole of farming and market gardening is, in future, to be treated for the purposes of Income Tax as a trade, and therefore taxed on profits; and only certain specific cases of farming are excepted from the operation of this change. The exceptions are limited to cases where the total annual value of the farm and market-garden land of an individual does not exceed £300, any proportion of rental of any farm where the individual is also a partner being reckoned for this purpose as part of the rental of lands held by him. Partnerships are also exempted from the profits basis where the whole partnership consists of persons who would themselves be exempted as individuals. The effect of these provisions is that the normal method of charging farm Income Tax is no longer on rental under Schedule B., but is now on actual profits as in other trades; but that under special circumstances of individual or partnership tenancy exemption may be claimed and the old basis of assessment under Schedule B. adopted. It will, however, be obvious that this wording makes the future alteration of the limit of exemption much easier, and it seems probable that in thus drafting the 1941 Act the Inland Revenue had this matter in mind.[1] The basis of assessment under Schedule D.—*i.e.*, on profits as an ordinary trader—is that tax is charged in any Income Tax year upon the profits made in the trade or business for the last accounting year ended prior to 5th April. For the year 1941-42, therefore, which is the first year of assessment on profits, the normal basis is the last completed farm accounting year ended prior to 5th April 1941. This may be the year to 28th May 1940, to 28th November 1940, to 31st March 1941, or to any other date within the year ended on 5th April 1941. Although notice had been given to the industry in the announcement of prices in 1940 that this change in the basis of taxation was contemplated, it was recognised that a large number of farmers might not have taken the necessary steps to preserve records of their farming transactions prior to the 1941 Act, and there was therefore incorporated in that Taxing Act a special provision to enable an individual to have his assessment for the year 1941-42 based upon the profits of the actual year to 5th April 1942. A strict interpretation of this provision involves the allocation on a time basis of the profits of two accounting years—if these do not happen to coincide with the tax year to 5th April; but in practice most Inspectors of Taxes will interpret this provision rather liberally and accept any accounting year ending between 31st December 1941 and 28th May 1942 as showing the actual profit of the year to 5th April. During the autumn of 1941 farmers liable to tax on actual profits received for completion a special form of return on which they were invited to make a statement of their profits for the appropriate year. If, as in many cases, they neglected or were unable or unwilling to do so, the Inspectors of Taxes, acting for the Commissioners, made an estimate of profits. Assessments based on these estimates were in due course sent to farmers, and the responsibility for appealing against the amount of these assessments, if considered excessive, lay with the farmer, who was invited to submit in support either of the original return or of the appeal a certified account of his trading transactions. In some cases the estimated assessments thus raised by Inspectors of Taxes exceeded the profits of the basis year, and this appeal procedure was followed. In other cases, however, the assessments were on sums less than the actual profits made, and many farmers, because of this or in the absence of accurate information, paid the tax demanded. It should not be assumed, however, that because the tax demanded on such estimated assessments has been paid the matter is in consequence finished. If it appears from subsequent accounts or from any other evidence that the amount of the original assessment was insufficient, the right of raising an additional assessment still rests with the Inland Revenue, and the responsibility for resisting excessive demands by the provision of evidence still rests with the farmer. The importance, therefore, of having accurate accounts, or at any rate of preserving the necessary evidence from which to prepare them, cannot be overemphasised.

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[1] Since this article was written the limit of exemption has been reduced to £100.

SURTAX.

Surtax is an additional tax imposed upon any income of an individual in excess of £2000. The first £500 over that sum is at present charged at 2s. in the £, and it rises in graduated scale to 9s. 6d. in the £, according to the total of the individual's income. Notice has been given, however, in the last Finance Act that the limit will be reduced to £1500 and that the rates will be revised—presumably increased. Diagram B. (appended) shows the combined effect of Income Tax and Surtax at present rates on the profits remaining to a farmer after paying Excess Profits Tax under the conditions exemplified in Diagram A., and on the assumption that the farmer is married, has two children, but has no other source of income than his farm profit.

BOOK-KEEPING SYSTEM.

In order to prepare a satisfactory statement of accounts it is necessary to have (1) a satisfactory book-keeping system, and (2) a valuation of farm live stock and crop on a consistent basis. Book-keeping is often regarded as an end in itself rather than as a means to an end. In one published textbook on the subject of Farm Book-keeping as many as sixteen books are prescribed, and the general conclusion which one would reach is that the subject requires an intricate knowledge of some complicated processes known as journalising, posting, debiting, crediting, &c., and the use of many books—cash-books, journals, ledgers, day-books, &c. Book-keeping for the average farmer neither is nor should be so difficult, intricate, or abstruse as this would tend to make one believe. The difficulties of book-keeping are largely imaginary, and can always be better solved by the application of common-sense than by a set of arbitrary rules. The first essential of a good book-keeping system is that it should be possible to prepare from it (*a*) an accurate Profit and Loss Account (a statement showing the transactions of any business over a period and the resulting profit or loss made therein); and (*b*) accurate Balance-sheets (statements showing the financial position of the business) at the beginning and end of the period covered by the Profit and Loss Account. It will have been observed that not only Profit and Loss Accounts but formal Balance-sheets are required to determine a considerable number of the reliefs in cases where Excess Profits Tax liability exists, as these depend as much upon the capital employed in the business as upon the profits made in the period. Even, however, where there is no liability to Excess Profits Tax, the preparation of balance-sheets serves the extremely important purpose of proving the accuracy of the Profit and Loss Account. If, for instance, a farmer who is originally 'worth' £10,000 makes a profit during the year 1941 of £3000 and withdraws from the business for private use (living expenses and/or outside investment) a total of £1200, then his balance-sheet at the end of the year must, if his book-keeping has been accurate, show net assets at £11,800. A satisfactory system of farm book-keeping, however, should be contrived, not only to enable such formal accounts and balance-sheets to be easily prepared, but also to enable the accounts to be prepared in the form in which they will give the farmer the greatest amount of useful information regarding the comparative results of his farming from year to year. From this point of view they should be so contrived that they not only present answers to the Inspectors of Taxes' questions about the profits and finance of the business, but also enable the farmer to determine which of his productive departments in any year are leaving a satisfactory margin of profit. They should also contain the data to form the basis of a future answer to a question of farm management, the nature of which is uncertain. This sounds difficult, but in order to accomplish it, it is only necessary that the books kept on a farm should aim at presenting the total profit and loss of that farm as a whole with a subdivision of expenditure and income into various classes, and the financial position of the farm at the balancing dates, and in addition form a record of, for instance, the amount of seed, dung, artificial manure, and labour expended on a certain crop, although these details are not incorporated in the formal accounts at all. If and when such details are required they are there, and can be searched out to be summarised and utilised. In order to serve these purposes a farm diary, a plain straightforward cash-book, and a plain ledger, preferably loose leaf, cannot be bettered. In the diary should be recorded the various happenings on the farm, such as births or deaths of animals, the applications of seed and manure, or the allocations of feeding-stuffs and the yields of crop obtained. In the cash-book all payments and receipts should be recorded in chronological order. This cash-book may conveniently be divided into two sections, in one of which are recorded those transactions which take place through the medium of the bank account—*i.e.*, cheques issued and monies lodged in the bank—and in the other those transactions which take place through the medium of hard cash—*e.g.*, petty sales, wages, and small payments. The cashing of cheques for 'self' or the payment of cash into the bank will in this system require two entries, one in each of the cash and bank sections. The individual entries in this cash-book should then be posted to the ledger, the various pages of which are opened to conform to the appropriate subdivisions and sections of the particular class of farming carried on. Systems of book-keeping which depend upon a cash-book with a multitude of columns in which are to be recorded the items of the various classes with which these columns are headed, appear to me to be too inelastic for general use—the number of columns is limited by the possible size of paper, whereas the number of ledger accounts which can be opened is not so limited—and they also appear to me confusing and to involve, if properly kept, much greater labour in addition and in balancing work than is necessary or desirable. Systems, on the other hand, which have separate pages for each class of income and expenditure without a chronological record of receipts and expenses suffer from the defect that if an omission is made it is almost impossible to find out in which section it has occurred. The cash-book and ledger are almost infinitely elastic, and can be adapted to the needs of the particular farm. The diversities in agriculture are great, and it is obvious that, unless elastic, a system suitable for a black-face sheep farm in the hills of Galloway will be unsuitable for a potato-growing and cattle-feeding farm in the valley of Strathmore. Special needs require special books designed to give the information required—a retail dairy round or a number of stallions earning fees to be paid on birth of foals are cases in point.

VALUATIONS.

It is essential to have a consistent basis of valuation. Since the stock of an average farm bears a far greater proportion to annual turnover than it does in the case of the average trader or manufacturer, errors in valuation have much more effect on farm profit and loss than on the profits of the trader. The first thing to realise is that a valuation for taxation purposes is quite a different thing from a valuation as between an outgoing and an ingoing tenant. The latter is quite rightly made on current market values, as it represents the price at which property passes from one ownership to another. It therefore takes account of profits or losses which the outgoing tenant ought to receive or bear. But with a valuation for taxation purposes the ownership remains the same, and it is the rule, accepted by the Inland Revenue, that whilst losses may be written off, profits need not be anticipated before they are made. Valuations for taxation purposes should therefore follow quite different rules to those adopted when valuations are made for transfer between owners, and should normally be based on cost—if necessary estimated cost—instead of on current market values.

The Inland Revenue recognises two kinds of property—capital and stock-in-trade. In general, the rule for differentiating between these classes is this :—

Capital stock consists of any more or less permanent property of any kind kept, in the case of a producer, for acting on raw materials in growing or manufacturing articles for sale, or, in the case of a trader, for enabling goods to be purchased and resold.

Stock-in-trade comprises goods in any state of production from raw materials to finished articles and goods purchased for re-sale.

Property may, of course, be capital in one set of circumstances and stock-in-trade in another. A tractor, for instance, is stock-in-trade in the hands of a manufacturer or dealer in implements, but is capital in the hands of a farmer. The main stocks at present recognised by the Inland Revenue as of a capital nature are implements and machinery. For determining profit and loss such articles need not be valued yearly. When the record is once made, annual depreciation can be written off at specified rates, and the market value of the implements and machinery is irrelevant. At present all other farm stocks are regarded as stock-in-trade, and for purposes of taxation the farmer can select "any reasonable basis of valuation if adhered to from year to year." This would appear to allow considerable latitude in choosing a basis of valuation, and many farmers at present favour the system based on the market value of such stock in preference to the accepted Inland Revenue formula "cost or market value whichever is the lower." This mainly arises from the fact that, when farmers have, for the first time, become assessable on actual profits during the currency of their present leases, valuation at market price results in allocating more profit to the period assessed on rental. It provides—at present high prices—some safeguard against excessive liability should the tenancy terminate for any reason during the war period. But there is the possible consequence that tax on paper profits in subsequent years may have to be met, and that liability for Excess Profits Tax on the increase in values since April 1939 may arise. If, on the other hand, valuations are based upon 'cost' (which may, if necessary, be estimated cost), profits are only brought into account when they have been actually realised and are not anticipated as they are when a market valuation is adopted. This means freedom from the possibility of having to pay tax on 'paper' profits, but, as the stock is valued at cost, the accounts start with a lower valuation now, and tax may eventually have to be paid in the last year of tenancy on a larger profit. In that year, of course, this profit is not a paper one, but has been actually realised. The opinion has been expressed that the Inland Revenue should, in introducing the new system of taxation, have granted the privilege of valuation at full market prices at the beginning of the first financial year subject to tax on actual profit and at cost thereafter. There would seem at first sight to be some justification for this having been done in view of the fact that previous profits had been assessed on the statutory basis of rental. The Inland Revenue, however, have pointed out that there was open to any farmer in the initial year of his tenancy the privilege of making a claim for repayment if his profits in the initial year fell short of his rental, and they therefore insist on the adoption in the first valuation of the same basis which is to be consistently followed by the farmer in subsequent years. Farmers coming under the new taxation for the first time are therefore faced with the alternative of valuing such stocks consistently upon market values or upon the principle of cost or market value whichever is the lower. This presents a considerable dilemma, and the decision as to which basis is best in a farmer's interests depends upon the particular circumstances of the individual case, including, for instance, the probable period of continued tenancy. Farmers who intend, however, to avoid the possibility of paying taxes on paper profits if prices rise further should make certain that their valuations can be justified on the basis of cost.

In the case of new tenancies where tax is charged on profits from the beginning, no difficulty of this kind will arise. The adoption of a cost basis is of definite advantage. In such a case the full prices paid by an incoming tenant are obviously 'cost' in the year in which he enters on tenancy, whilst at the end of his first year's farming no profits on unrealised crops or stock need to be anticipated and the valuations are made at estimated cost. This procedure results in showing during the first year of tenancy a much lower profit than if market values are adopted, with the consequent benefit to the ingoing tenant of much lower taxation in the initial, and usually more impecunious years of his tenancy. The first year's accounts govern the Income Tax assessments for the first and second years and in most cases the third year as well. This system of valuation is therefore beneficial on the long view to the economic condition of the industry as a whole. Valuation at cost is the normally accepted basis in the case of other industries where formal accountancy has been in vogue for many years, and it is certain that, as present leases fall out and new tenants enter, this basis of valuation will become that generally adopted in agriculture as well. Valuation at cost presents some features which it has not been usual for farmers or valuers to consider, but which are not really difficult. The valuation of potatoes in a pit, or grain in a stack, for instance, is usually made by reference to estimated quantity and market value; but if a cost basis of valuation is adopted, it must then be estimated by reference to the acreage from which the crop was produced and the costs of cultivation and harvesting, without relation to the quantity or present value of the produce obtained. Only in exceptional cases, where the quantity is so small or the quality so bad that the market value of the produce is less than the cost of production, does the market value require to be taken into account. This method of valuation at cost is perhaps best explained by examples. Valuations on this basis of the produce of one acre of potatoes in Angus, the produce of one acre of barley in Easter Ross, and of an Ayrshire calving quey at the age of two years and nine months are appended. It will be noted that in each case the valuation at cost results in the adoption of a figure considerably less than market value. If market valuations are adopted, profit is anticipated and tax has to be paid thereon. The advantage of the adoption of the cost basis will therefore be apparent. These methods of valuation have, until now, been unusual in agriculture, but they present no real difficulty to any competent farmer or valuer once the underlying principle of cost is fully grasped. It should be noted that if the cost principle is properly followed, oats grown on a high-lying farm where cultivation is difficult will be valued at more per acre than those from a good low-lying arable farm. As the yield from the former is likely to be less than that from the latter, the valuation of oats from high-lying places, if carried out at cost, will work out at much more per quarter than that for oats from a low-ground farm, in spite of the fact that the quality is unlikely to be as good.

The truth is, however, that more profit is in fact made from low-ground oat growing than from high; and as it is this profit which should not be anticipated as far as tax is concerned, it follows that it is quite correct that oats from low ground should be valued at less than oats from high.

FORM OF ACCOUNTS.

The form in which the annual accounts of any farm are presented is important. It is desirable that the form be designed, not only to serve as a proper basis for taxation, but also to make it easy for the farmer to compare the result of his farming one year with the other. From that point of view the most common type of farm account—which follows the form originally published by the Inland Revenue Department—provides practically no figures which are comparable one year with the other. The general set-out of this form is as follows:—

Valuation at beginning of the year (in detail).	Cash sales (in detail).
Cash purchases and expenses (in detail).	Valuation at end of year (in detail).
Add amounts owing by the farm at end of the year (in one sum).	Deduct amounts owing to the farm at beginning of year (in one sum).
Less amounts owing by farm at beginning of year (in one sum).	Add amounts owing to farm at end of year (in one sum).

It will be observed that on one side of this form is set out the valuation at the beginning of the year, to which is added the purchases and expenses for cash, and the resultant sum is then adjusted for amounts owing by the farmer at the beginning and end of the year. On the opposite side are recorded the sales and valuation at the end of the year, which are similarly adjusted for amounts owing to the farmer at the balancing dates. The difference between the two sides brings out the total profit or loss for the period. This form gives information as to the general profit or loss; but if an attempt is made to compare, for instance, the sales of a particular class of product in one year with the sales of the similar product in another year, it is found that the figures are not at all comparable, and that until the form has been entirely recast no comparative data can be arrived at. This type of account is of little use to the farmer except to determine his total profit and loss and to adjust his tax liability. When, for instance, it is desired to compare the yield of dairy produce in one year with the yield in another, it will be found necessary to extract figures appearing on the face of the account at various parts of it. If there are stocks of cheese at the beginning and end of the year of different quantities, unless such differences are taken into account in arriving at the figure for production of cheese, any comparison of the sales figure will be grossly misleading. Then, too, it may happen that there is included in the figures of debts due to the farm amounts due for cheese, and these amounts may not be equal at both ends. Any differences in this respect must also be adjusted. Similarly, to discover the relative figures between one year and another in respect of profitability or otherwise of sheep, it is necessary to collect together the figures of stocks of sheep, of sales and purchases of sheep, of debts due by and to the farm for sheep at each end of the year, and to put these together in some such method as the following :—

DAIRY.

(*a*) *Produce*—			
(*a*) Cheese stock at 28/11/40		£427 10 0	
Add : Sales		981 0 11	
		£1408 10 11	
Less : Stock, 28/11/39		387 16 8	
		£1020 14 3	
Milk—Sales		533 8 5	
			£1554 2 8
(*b*) *Cattle*—			
Stock as at 28/11/40		£2705 0 0	
Add : Sales		614 16 5	
		£3320 16 5	
Less : Purchases	£98 5 0		
Less : Stock, 28/11/39	2839 10 0		
		2937 15 0	
			383 1 5
			£1937 4 1

SHEEP.

Stock as at 28/11/40		£268 11 6	
Add : Sales		720 13 7	
		£989 5 1	
Less : Purchases	£137 2 6		
Less : Stock 28/11/39	528 18 0		
		666 0 6	
		£323 4 7	
Add : Wool sales		27 10 4	
			£350 14 11

If, on the expenses side, the total expense of manuring is to be compared, the purchase figure must be similarly adjusted with the stocks, the unpaid bills, if any, and the Land Fertility Grant received or receivable, as follows :—

MANURE.

Purchases		£502 8 10	
Add : Stock, 28/11/39		120 0 0	
		£622 8 10	
Less : Amounts received under Land Fertility Scheme	£23 1 1		
Less : Stock, 28/11/40	146 10 0		
		169 11 1	
			£452 17 9

Sales and purchases in the above examples are cash receipts or payments adjusted for debts due at beginning or end of the year.

A farm account in which the figures are presented in this form will then serve the dual purpose of satisfying the Inland Revenue, and yet providing a maximum of guidance in management for the farmer. A full specimen of a farm account and balance-sheet in the form recommended is appended.

Some farmers may wish to go further than this and to allocate against the gross profits of the productive departments determined as in the examples given, such as Dairy, Sheep, &c., the direct costs of feeding, wages, &c., attributable to each enterprise. For this purpose it will be necessary to call the farm diary into use to determine the relative proportion into which wages, feeding-stuffs, and other costs should be split between the productive accounts. In carrying out this operation the advantage of having a ledger system of accounts will immediately be apparent, as with that system it is possible to make the cross entries with great ease between, for instance, the wages and feeding-stuffs accounts, and those for the Dairy, Sheep, or Pigs without requiring any additional books for the purpose. When this process has been carried out a clear view of the actual result of the year's trading can be obtained from the resulting net Profit and Loss Account, which will show figures in the following form:—

PROFIT AND LOSS ACCOUNT.

Oncost Charges—				*Balance on Productive Accounts after Charging Costs—*						
Rent	£302	10	0							
Rates	14	4	8	Dairy	£1327	9	5			
Insurance	13	2	4	Sheep	169	15	1			
Upkeep of motor-car	97	15	1	Pigs	206	3	7			
Depreciation of car	37	7	0					£1703	8	1
Tradesmen's accounts	40	11	10	*Miscellaneous Receipts—*						
Fencing	24	5	6	Grazing	£11	0	0			
Miscellaneous charges	59	18	4	Prize money	6	10	5			
Net profit	1137	3	3	Sundries	5	19	6			
								23	9	11
	£1726	18	0					£1726	18	0

The decision as to what is a productive department must depend on the individual circumstances of each farm. It will be obvious, for instance, that in the case of most dairy farms situated far from markets, turnips are not a productive account, being merely a step in the production of milk or cheese. They should not, therefore, show either profit or loss, whilst in farms nearer market centres they may quite well form a productive account and contribute their share towards the general fund. In Angus it is probably quite correct to consider cattle feeding as merely one step in the production of potatoes—that step which produces, at the cheapest cost to the farmer, the manure necessary for growing the crop. Normally, on the other hand, cattle feeding will be a productive account. It should be emphasised, therefore, that one account which may in a certain farm, under one set of conditions, be a productive account will, in another farm, under different conditions, be merely a subsidiary one.

Final Adjustments on Accounts.

In completing the accounts there are a number of points which require adjustment.

1. *Household Account.*—The farmer's household must be treated as a separate entity from the farm business and therefore be excluded from the farm. There must be credited to the farm account any produce, such as milk, potatoes, eggs or live stock taken into the house, or any service such as carting performed by farm men for household. On the other hand, there must be charged to farm profit the board provided for members of a family who work on the farm and/or for workers boarded. In making credit for this produce it should be remembered that it is to be priced not at what it could be sold for but at its estimated cost. No one is required to make a profit by trading with himself. Similarly the rate for board charged for workers should be estimated cost. Normally the rate allowed by the Agricultural Wages Board will be accepted without question, but if satisfactory evidence can be produced that the actual cost of board and lodging is more than those rates this should be charged. A charge should also be made for the keep of working dogs, for meals supplied to casual workers, or for any other service provided by the house to the farm.

2. *Family Wages.*—Charges should be made in the farm account for the salaries of a wife or any members of a family who actually work on the farm. These payments should, if it is intended to claim them as deductions for taxation, be actually paid. The rates charged should be reasonable and commensurate with the services performed, and the payments should be made in the same way and at the same intervals of time—weekly, monthly, or half-yearly—as is normal in the case of other workers. A yearly payment, where other workers are paid weekly, is not normally acceptable to the Inland Revenue Authorities. It should, of course, be noted that any salary paid to a wife must be included in the appropriate section of the husband's Income Tax Return.

3. *Debts Due.*—All sums due to and by the farmer at the end of the year should be allowed for and taken into account as due—being added in each case to the appropriate section of the receipts or purchases in the Profit and Loss Account.

ADJUSTMENT OF TAX LIABILITY WITH INLAND REVENUE.

Farmers are entitled to keep and state their accounts in the way which seems to them best, but it does not follow that the Inland Revenue must necessarily accept the profit or loss thus brought out, as in assessing Income Tax on a national basis certain rules for the determination of profit and loss must be followed. This process of adjusting a farmer's profit in accordance with these general rules is known to the Inland Revenue as 'computing' the profit. The usual matters dealt with in this process of computation are the cases of the owner-occupier and the depreciation or replacement of implements and plant. These two questions might usefully be further explained. In the case of an owner-occupier's accounts either full rent will be charged or no rent at all, but for taxation purposes the amount to be charged against profit is that known as the net Schedule A. Assessment—*i.e.*, the rental value of the farm as reduced by the statutory allowances for owner's rates and repairs. If the full rent is charged to the farm account this will be added to the profits, and the net Schedule A. assessment deducted. Repairs to the farm property, in so far as they are repairs as such, will be charged or allowed for in this computation, but improvements will not be so charged. Under the heading of repairs will be the normal expenses of draining as reduced by the grants, if any, from the Department of Agriculture in this respect. As regards implements, it is common practice in accounting to charge against profit and loss depreciation, but for taxation purposes a farmer will have the alternative of taking this, which is known to the Inland Revenue as wear and tear, or replacements. Under the former system he will be entitled to charge depreciation at certain rates agreed between the Inland Revenue and the National Farmers' Union, and these rates will be allowed yearly on the written-down value of the implements or machinery in question. These agreed rates will be increased by one-fifth to allow for exceptional depreciation, and this one-fifth will not be deducted from the balance value appearing in the balance-sheet. If, on the other hand, the replacement system is adopted it will mean that instead of charging depreciation at agreed rates, there will be charged against the profits of the year the cost of any new implements of the same type purchased to keep the stock of machinery and implements 'up to strength.' The implements must be of the same type. If, for instance, a Fordson tractor is replaced with an International, the whole cost of the International cannot be charged, but only that portion of the cost which would have been incurred had the Fordson been replaced with a Fordson, and there must be credited any scrap price received for the old Fordson disposed of. The cost of new implements cannot be allowed if they form an addition, and if, for instance, the previous tractor is retained for use. The decision as to whether replacements or depreciation is more advantageous depends upon the circumstances of each individual case. On large farms where many replacements take place this may be the better method, but on small farms the more equitable system is usually that of annual depreciation, as there may be some years when no replacements at all take place.

USE OF FARM ACCOUNTS.

Farmers as a class have, in the past, been reputed to be notoriously bad book-keepers; and it is true that the theory and practice of accounting have not up till the present been given sufficient attention by the industry. Properly regarded, a farm account is merely a picture of agricultural facts—a representation in figures of the practical experience of farming. No attempt should be made to force upon the farmer a stereotyped system of book-keeping, the evolution of which has mainly been in industrial accounting; the matter should be kept as simple as possible and the accounting system adapted to meet the particular needs of the individual farm. Where this is done no farmer will consider book-keeping as intricate or burdensome, but will come to regard his accounts not only as the basis on which he is taxed, but also as a valuable help in the day-to-day management of his farming business.

APPENDIX I.

Valuation at Cost of the Produce of 1 acre of Arran Pilot Potatoes grown for Seed, in Angus. Season 1939.

Valued in Pit at 31*st January* 1940.

Item.	*Cost.*			*Notes.*
Seed	£15	0	0	3 tons ware at £5, or 30 cwts. seed at £10.
Artificial Manure	2	16	0	8 cwts. potato manure at £7.
Dung	7	10	0	15 loads per acre at 10s.
Ploughing	1	5	0	
Grubbing	0	4	3	1 man and 3 horses—average 6 acres per day.
Cultivating	0	2	9	1 man and 2 horses—average 10 acres per day.
Harrowing	0	2	0	
Carting and spreading dung	1	10	0	15 loads per day at £1. Spreading, 10s.
Drilling	0	7	6	
Carting artificials	0	2	0	
Sowing artificials	0	5	0	
Carting and distributing seed	0	10	0	
Planting—average	0	7	6	10s. if ware; 5s. if seed.
Happing	0	7	6	
Harrowing down	0	5	0	Twice.
Furring up	0	15	0	Twice.
Drilling weeds and cleaning	1	10	0	grubbing 4 times, £1. Hand hoeing, 10/-.
Furring up	0	15	0	Twice.
Rogueing	0	5	0	10s. per day. 2 acres per day.
Examination by D.O.A.S.	0	2	6	Paid out.
Spraying	1	0	0	Done twice.
Burning down	1	5	0	
Digging and carting	1	15	0	9 men per day for 4 acres, 6 horses, 1 tractor—£7.
Picking	2	0	0	With casual labour and including driving costs.
Covering pit	1	8	0	7 cwts. wheat straw per acre used.
Work	0	13	0	Includes additional covering for frosts.
Rent, rates, insurance, and oncost	3	12	0	
Gross Total	£45	15	0	
Less Residual manurial value	3	15	0	No value carried forward for artificials. Half cost of dung—dressing heavier than for other crops.
Net cost	£42	0	0	

Valuation, at cost . . . . £42 per acre.

Valuation at market value (less estimated marketing)—

7 tons seed at £9 per ton	£63	
2 tons ware at £4, 10s. per ton	9	
	——	£72 per acre.

APPENDIX II.

Valuation at cost of Produce from 1 acre of Barley, grown Season 1941, in Easter Ross.

Valued in Stack at 31*st December* 1941.

Item.	*Cost.*			*Notes.*
Seed	£2	0	0	4 bushels per acre at 80s. per quarter.
Laying out seed	0	1	0	
Manure	0	12	6	2½ cwt. phosphatic manure at £5 per ton.
Ploughing	1	0	0	
Harrowing	0	2	6	2 strokes—10 acres per day.
Drilling seed	0	3	0	
Manure sowing	0	2	6	
Carting manure	0	1	0	
Harrowing	0	2	6	2 strokes—10 acres per day.
Rolling	0	2	0	
Harvesting—				
Opening roads	0	1	0	
Cutting	0	3	6	1 man, 3 horses—1 acre per hour.
Binder twine	0	6	6	
Stooking	0	4	0	
Carting and stacking	1	0	0	4 men, 1 land girl and 2 horses—4 acres per day.
Thatching	0	2	0	
Straw and rope for thatching	0	10	0	
Rent, rates, insurance, and oncost (say)	2	10	0	
Total	£9	4	0	

Valuation, at cost				£9, 4s. per acre.
Valuation at market value—				
4 quarters barley at 120s. per quarter	£24	0	0	
15 cwt. straw at £3 per ton	2	5	0	
				£26, 5s. per acre.

APPENDIX III.

Valuation at cost of a back-calving Ayrshire Heifer (age 2 years 9 months at 31st October 1941).

Initial cost at birth, 1st February 1939 (say)		£3 0 0

This figure will be increased if specially pedigreed or attested stock is concerned. The 'cost' in such a case should include part depreciation of sire and dam.

February 1939 *to January* 1940—		
Cost of milk for 2 months—60 gallons at 1s. 4d. per gallon		4 0 0
Cost of skim milk or milk substitute with cod-liver oil—1¼ gallons per day for 1 month at 6d. per gallon (say)		1 0 0
(Any hay consumed in this period would be offset by dung.)		
60 lb. concentrates—6 weeks		0 7 6
2 cwts. hay at 5s. per cwt.—6 weeks		0 10 0
Grass—2½ months (say, 10 weeks) at 1s. per week		0 10 0
Foggage—12 weeks at 1s. 3d. per week		0 15 0
Feeding—2 months :—		
Meal—say, 1 cwt.	£0 16 0	
Turnips	0 2 6	
Hay—1½ cwts. per month	0 15 0	
		1 13 6
Labour for year		1 10 0
Cost at 1 year old		£13 6 0
		£13 6 0
February 1940 *to January* 1941.		
Feeding—2½ months :—		
Hay—2 cwts. per month	£1 5 0	
Meal—1 cwt.	0 16 0	
Turnips—12½ cwts.	0 12 6	
		2 13 6
Grass—6 months		2 0 0
Feeding—3½ months :—		
Hay—2 cwts. per month	£1 15 0	
Straw	0 7 0	
Turnips—6 cwts. per month	1 1 0	
		3 3 0
Labour per year		1 0 0
Cost at 2 years old		£22 2 6
		£22 2 6
February 1941 *to October* 1941.		
Feeding—3 months :—		
Hay—2 cwts.	£1 10 0	
Straw	0 6 0	
Turnips—6 cwts. per month	0 18 0	
		2 14 0
Grass—6 months		3 0 0
Labour		1 0 0
Service of bull		0 10 0
Total		£29 16 6

Valuation, at cost, say, £30 ; at market value, £45.

SPECIMEN

ALASTAIR MACKAY

PROFIT AND

For the Year ended

EXPENSES.

FEEDING-STUFFS.			
(*a*) *Cakes and meals*—Purchases		£538 3 5	
Add : Stock, 28/11/40		39 7 9	
		£577 11 2	
Less : Stock, 28/11/41		36 0 0	
			£541 11 2
(*b*) *Oats, straw, and green-crop*—Purchases		£254 5 11	
Less : Sales		46 18 6	
		£207 7 5	
Add : Stock, 28/11/40		334 0 0	
		£541 7 5	
Less : Stock, 28/11/41		377 14 3	
			163 13 2
MANURE—Purchases		£613 2 4	
Add : Stock, 28/11/40		113 12 11	
		£726 15 3	
Less : Sales	£9 7 0		
Stock, 28/11/41	107 14 0		
		117 1 0	
			609 14 3
Grass Seeds			96 3 5
COAL—Purchases		£57 19 0	
Add : Stock, 28/11/40		10 0 0	
		£67 19 0	
Less : Sales and house	£23 1 7		
Stock, 28/11/41	8 8 0		
		31 9 7	
			36 9 5
Dairy Stores			3 15 1
Dip			22 4 8
Binder twine			6 2 6
Wintering and outside grazing			97 0 0
Wages and perquisites			1341 1 4
Rent			520 0 0
Rates			24 17 8
Insurance (including War Risks)			58 18 10
Overdraft interest			1 2 0
Veterinary surgeon and medicine			30 18 1
Fencing and hedging			19 6 0
Repairs and maintenance			160 12 7
Motor-car upkeep			79 5 9
Miscellaneous			86 8 0
DEPRECIATION WRITTEN OFF.			
Gas plant		£5 6 0	
Motor-car		26 0 0	
Implements		36 3 4	
Milking plant		10 3 0	
Boiler		5 8 0	
			83 0 4
BALANCE, being profit for year			1765 16 10
			£5748 1 1

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* This specimen account is not the account of any special farm. It has been prepared as an example only. Any apparent resemblance to the conditions of any actual farm is purely coincidental.—E. A. B.

ACCOUNT.*

MAINS OF A.B.C.

Loss Account.

28th November 1941.

GROSS PROFITS

Dairy Account—Milk sales (including supplies to house)			£1249 8 11
Cattle—Sales		£216 17 5	
Add : Stock, 28/11/41		914 0 0	
		£1130 17 5	
Less : Purchases	£81 3 9		
Stock, 28/11/40	843 10 0		
		924 13 9	
			206 3
Sheep—Sales (including wool and subsidy)		£1016 1 4	
Add : Stock, 28/11/41		1085 17 6	
		£2101 18 10	
Less : Purchases	£304 17 8		
Stock, 28/11/40	910 9 0		
		1215 6 8	
			886 12
Poultry—Sales (including supplies to house)		£65 13 8	
Add : Stock, 28/11/41		10 0 0	
		£75 13 8	
Less : Stock, 28/11/40		15 10 0	
			60 3
Pigs—Sales		£34 0 7	
Less : Purchases		10 2 6	
			23 18
Horses—Sales		£44 11 0	
Add : Stock, 28/11/41		231 0 0	
		£275 11 0	
Less : Purchases and service fees	£36 0 0		
Stock, 28/11/40	231 0 0		
		267 0 0	
			8 11
Crop Sales.			
Potatoes—Sales and subsidy		£3806 16 0	
Add : Stock, 28/11/41 (seed)		636 0 0	
		£4442 16 0	
Less : Purchases	£631 6 3		
Stock, 28/11/40 (seed)	592 10 0		
		1223 16 3	
			3218 19
Turnips and mangolds—Sales			28 9
Miscellaneous Receipts.			
Discount			61 14
Cartage for house			4 0
			£5748 1

MAINS OF

PROPRIETORSHIP

	£	s.	d.
To Schedule A. Tax	£123	3	9
" Owner's rates	26	6	11
" Stipend	39	13	10
" Fire insurance on buildings	6	3	0
" War Damage Tax	8	18	9
" Bond interest, net	84	13	1
" Balance to Capital Account	231	0	8
	£520	0	0

ALASTAIR

MAINS OF

BALANCE

As at 28th

Liabilities.

Debts due by farm			£482 16 2
Capital—			
Balance as at 28/11/40		£12,614 19 11	
Add : Deposit Receipt interest		55 18 7	
Investment income		107 19 4	
Proprietorship Account balance		231 0 8	
		£13,009 18 6	
Less : Private drawings	£627 10 9		
Tax Reserve Certificate and Investments purchased	1400 0 0		
Produce, &c., to house	23 7 2		
		2,050 17 11	
		£10,959 0 7	
Add Profit for year		1,765 16 10	
			12,724 17 5
			£13,207 13 7

A.B.C.

ACCOUNT.

By Rent	£520 0 0
	£520 0 0

MACKAY.

A.B.C.

SHEET

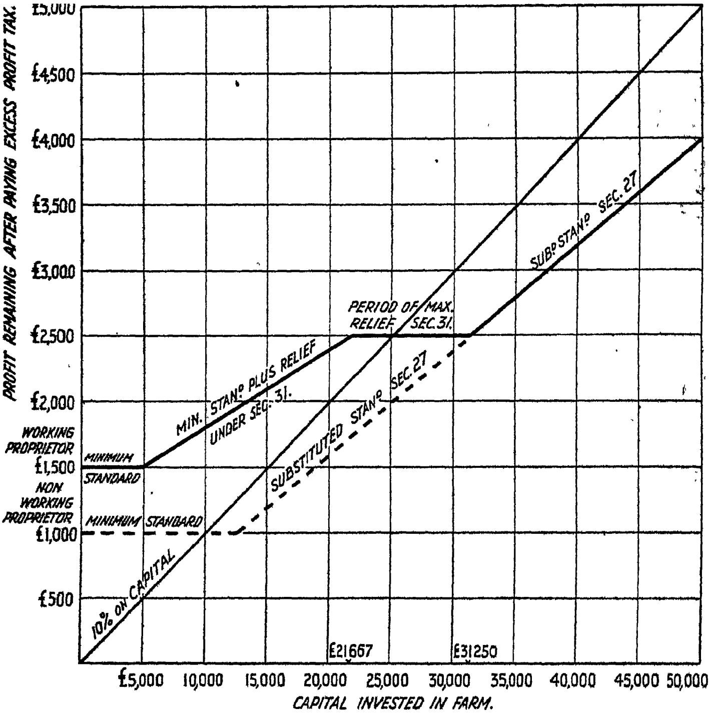
November 1941.

Assets.

Property		£10,000 0 0	
Less: Bond		4,500 0 0	£5,500 0 0
Gas Plant—Balance at 28/11/40		£24 5 0	
Less: Depreciation		5 6 0	18 19 0
Motor-car—Balance at 28/11/40		£130 0 0	
Less: Depreciation		26 0 0	104 0 0
Implements—Balance at 28/11/40	£291 0 0		
Additions during year	70 13 9		
		361 13 9	
Less: Depreciation		36 3 4	325 10 5
Milking Plant—Purchased during year		£140 3 0	
Less: Depreciation		10 3 0	130 0 0
Boiler—Balance at 28/11/40		£54 0 0	
Less: Depreciation		5 8 0	48 12 0
Live Stock, Crops, &c.—Valued at		£3406 13 9	
Cultivations and Unexhausted Manurial Residue—valued at		110 0 0	3,516 13 9
Debts due to farm			671 17 8
Cash—At bank—			
On Current Account—Royal Bank of Scotland, X. Branch		£88 16 2	
On Deposit Receipt— ,, ,,		2051 0 0	
Clydesdale Bank, Y Branch		728 2 0	2,867 18 2
Cash—On hand			24 2 7
			£13,207 13 7

DIAGRAM A.

Graph showing Relation between (*a*) Profit left after paying Excess Profits Tax on the assumption that the pre-war standard applicable is the Minimum Standard, with the maximum reliefs usually permitted under Sections 27 and 31 of the Finance Act, 1940; and (*b*) a rate of 10 per cent on Invested Capital.



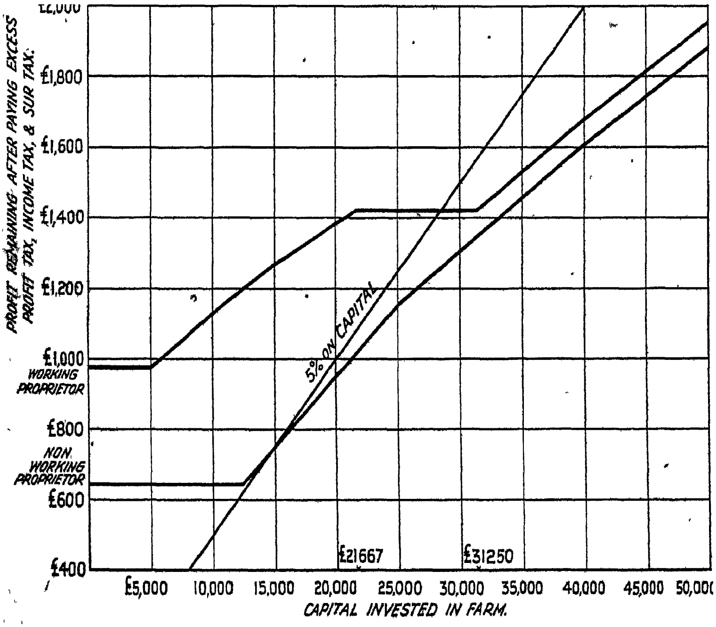
Notes.—It will be observed—

(1) That in the case of a Working Proprietor with Capital between the limits of £21,667 and £31,250 no added relief can be obtained under any section. Relief under Section 31 reaches the maximum permitted at the former figure, and relief under Section 27 only starts to operate at the latter.

(2) That Non-Working Proprietors with over £10,000 of Capital and Working Proprietors with over £25,000 are left with less than 10 per cent on their Capital after paying E.P.T.

DIAGRAM B.

Graph showing Relation between (*a*) Profit left after paying Excess Profits Tax on the conditions referred to in Diagram A., and after deducting in addition Income Tax and Surtax payable by a married man with two children and no other source of Income other than the Farm; and (*b*) a rate of 5 per cent on Invested Capital.



Notes.—

(1) The curvature is caused by the increasing incidence of Surtax.

(2) The difference after £31,250 of Capital between a Working Proprietor and a Non-Working Proprietor is due to disallowance of Earned Income Relief in the latter.

(3) In both Diagrams A and B Profits left to a Working Proprietor include personal salary or wage earnings.

THE PARASITIC WORMS OF SHEEP IN SCOTLAND AND THEIR CONTROL.

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INTRODUCTION.

From the time sheep were domesticated for the benefit of mankind their parasitic worms have been a source of increasing loss. Progress in the improvement of pastures has led to more sheep per acre and more worms per sheep, and the problem of readjusting the balance between the animal and its worm burden has become particularly acute, as farmers are faced with the task of maintaining the health of their flocks under conditions especially favourable to internal parasitism. It has been said that our war-time agricultural policy, with its ploughing-up of old sheep-sick pastures, should help to solve the problem. This would no doubt be the case if a corresponding reduction in the number of sheep was made; but the tendency has been to maintain flocks at full strength, with the result that the balance has been upset in favour of increased, rather than reduced, worm infestation.

The usual method of control is dosing with some brand or brands of worm medicine, but this, in many cases, has proved unsatisfactory. This is partly explained by the fact that worm medicines are often given without first attempting to find out the type of worms responsible for the damage—that is, whether it is flukes, tapeworms, or roundworms. There is no drug capable of destroying all three types, and, while one drug may be successful against one type, it may leave the others unaffected. Another explanation is that worms are often blamed for all 'ill-thriven' sheep, and many are dosed for worms when their poor condition is due to entirely different causes. It should be clearly understood that parasitic worms are only one of the many causes of ill-health, and that worm medicines cannot be expected to cure all manner of complaints.

This article has a twofold purpose—namely, to discuss the worms of importance in sheep and to review the question of their control, especially in regard to methods of pasture and sheep management.

WORMS FOUND IN SCOTTISH SHEEP.

In order to obtain first-hand information on the problem of worms affecting Scottish sheep a survey was begun in the summer of 1933. The first point to determine was the degree to which sheep were affected by worms and the measures taken by farmers for their control. A questionnaire with an explanatory letter was posted to 1625 sheep farmers—857 breeders of pure Border Leicester, Cheviot and Blackface flocks and 768 breeders of commercial sheep—whose names were supplied by the county agricultural organisers. Of the 572 completed questionnaires returned, 310, or 54 per cent, reported losses from suspected worm infestation and answered the questions submitted. The value of these collectively is noteworthy, and it is therefore proposed to review them briefly.

The first question addressed to the farmer was: "Do your lambs appear to fall back in condition in the autumn?" Of the 63 per cent of farmers who answered this question, 43·2 per cent stated that their lambs fell back in condition in the autumn, 17·4 per cent in the summer, and 3·2 per cent in the spring. Autumn, therefore, would appear to be the period when lambs generally tend to lose condition, but it should be noted that the period varies to some extent with the district. For example, in Aberdeenshire 80 per cent of the farmers who replied gave autumn as the period, while in Berwickshire 70 per cent of the replies mentioned summer as the critical time. Generally speaking, lambs tend to fall back in condition in autumn in the north of Scotland, and in the latter part of summer in the south of Scotland.

To the next question asked: "Do you suspect losses in your lambs through worms? If so, what methods are you employing to check these losses?"—the replies revealed that no less than 75 per cent were attempting to check their losses by the use of drugs. Only 6 per cent stated that their lambs improved after dosing, and 3 per cent definitely declared that dosing was ineffective. Perhaps the most interesting information revealed in this question was the nature of the drugs used. Table I. shows a list of the drugs employed in order of frequency of use.

TABLE I.

WORM MEDICINES AND THEIR FREQUENCY OF USE AS REVEALED BY SURVEY.

Worm Medicine.	Frequency.
Cooper, MacDougall & Robertson's Worm Tablets	117
Copper Sulphate, 1 per cent solution	59
Copper Sulphate tablets	5
Carbon Tetrachloride	32
Turpentine and Milk	25
Turpentine and Linseed Oil	4
Day, Son & Hewitts' Worm Pills	17
Day, Son & Hewitts' Worm Drench	2
Kylemal	11
Ovidyne	10
Boots' Worm Mixture	6
Extract of Male Fern	5
Worm Capsules (unnamed)	4
Anti-Worm Pills (unnamed)	4
Proprietary medicines (unnamed)	3
Mixture from local Chemist	3
Mixture from local Veterinary Surgeon	2
Sulphur	2
Carbon Tetrachlorethylene	1
Cataline	1
Huskyline	1
Tar	1
Mixture of Iron Sulphate, Red Cinchona Bark, and Gentian	1

It is interesting to note also that the nature of the drug varied to some extent with the district. For instance, in Aberdeenshire Cooper's Worm Tablets were almost exclusively used, whereas in Roxburghshire ten different drug were employed.

Other methods adopted in the way of checking losses ar indicated in Table II. :—

TABLE II.

Method.	Percentage of tota occurrence.
Change of pastures	8·0
Decreasing size of flocks	2·5
Feeding concentrates	1·3
Ploughing up pastures	1·3
Liming pastures	1·0
Grazing with cattle	1·0
Use of mineral licks	1·0
Change to foggage or aftermath	1·0
Salting pastures	0·6
Use of salt licks	0·6
Keeping pastures clean	0·6

The list is an interesting one; and although the percentage of farmers employing these methods is small, it shows that some are alive to the possibility of controlling parasitic worms by ways other than the use of drugs.

That a change to fresh pasture should head the list of methods is more or less to be expected, as most farmers are aware of the danger of keeping sheep too long on the same ground. Only eight farmers, or 2·5 per cent of the total replying, had attempted to check their losses by decreasing their flocks, a not unexpected result in view of the absence of any attractive alternative enterprise. Four farmers stated that they adopted the use of concentrates; but during personal visits to various farms throughout the counties of Scotland it was found that the practice was much more widespread than analysis of questionnaires had shown. The concentrate frequently given was a mixture of bruised oats and linseed cake. Two farmers stated that from five to ten cwts. of rock salt to the acre of grass helped to reduce worm infestation. In fact one of them put it even more strongly and said that the application of rock salt to pastures was the only reliable method of dealing with the worm problem. Mineral and salt licks were also used, but no mention was made of the efficacy of these methods. Three farmers favoured the use of lime, and an equal number were of the opinion that grazing cattle along with sheep helped to reduce worm infestations. Two farmers stated that rabbits were largely to blame for the incidence of worms in sheep, but there are many more of this opinion. The probable origin of this belief is that most farmers have seen for themselves to what extent rabbits may become parasitised with tapeworms.

There is another point worthy of comment—namely, the number of farmers complaining of scouring in their lambs towards the end of summer and beginning of autumn. Scouring is a serious problem as it leads to a soiling of the wool in the hind-quarters, and thus increases the danger of Maggot Fly (*Lucilia sericata* Meisen) damage. Many believe that the scouring is due to worm infestation and dose their lambs accordingly; others blame wild white clover. Probably both factors are of major importance in the causation of scouring, but the problem awaits further investigation.

One gratifying feature of the replies was the number (10 per cent) of farmers who enclosed covering letters with their questionnaires giving fuller details of their methods of sheep management, and expressing their willingness to give every assistance and encouragement in the investigations.

Since the survey was concerned chiefly with roundworm infestations, its scope was confined mainly to lambs between the ages of three and six months. In order to obtain an immediate bird's-eye view of the situation a wide area was covered. Farms were visited and material obtained from each county in Scotland, including the Shetland Isles and Hebrides. In all, a total of sixty-one farms was visited and thirty-three sheep examined. At each examination the lungs, liver, and gut were inspected by naked eye and palpation; while the contents of the fourth stomach, small gut, and large gut were separately bottled and preserved and taken back to the laboratory for closer inspection and individual counting of worms. The history of each lamb was obtained and noted. Perhaps the most valuable part of the work was the opportunity for personal discussion with flockmasters themselves.

The following is a brief summary of the results of the survey :—

Lambs up to six months of age were infested with two species of tapeworms and eighteen species of roundworms; adult sheep with two species of flukes, four species of tapeworms, and twenty-one species of roundworms.

The lesser stomach worm (*Ostertagia circumcincta*) was the most common of all the species found, and in approximately half of the lambs examined counts of from 3,000 to 19,000 worms per lamb were obtained.

No flukes were recovered from lambs under six months of age, but signs of fluke disease were observed in five of the eleven hill flocks inspected.

Symptoms of sturdy caused by the bladderworm, *Cœnurus cerebralis*, were observed on ten of the sixty-one farms visited. The disease appears to be commonest in Inverness-shire.

Bladderworms of the dog tapeworm, *Echinococcus granulosus*, which are particularly dangerous to man, were obtained from an adult sheep sent for examination.

The common tapeworm, *Moniezia expansa*, was recovered from a third of the lambs, but in small numbers.

On two occasions a heavy infestation of *Nematodirus* spp. was found, and, along with *Trichostrongylus* spp., there is evidence that these roundworms in the small gut play an important part in reducing the health of flocks.

The sheep hookworm, *Bunostomum trigonocephalum*, was obtained in largest numbers towards the end of September and beginning of October. Up to 281 hookworms were recovered from one lamb without evidence of a pathological condition of the small intestine.

Lesions of chabertiosis, due to infestation with the roundworm, *Chabertia ovina*, were found in three sheep from different farms, and over 200 of this species were recovered in each case.

Trichuris ovis, a roundworm parasite living in the cæcum, usually regarded as innocuous, was recovered in large numbers from a three-months-old lamb in Roxburghshire. The lining of the cæcum was highly inflamed and thickened.

The most common species of lungworm was *Muellerius capillaris*, followed by *Dictyocaulus filaria* and *Protostrongylus rufescens*.

Two roundworms, *Ostertagia ostertagia* and *Cooperia oncophora*, were for the first time recorded in Scottish sheep.

A complete list of the types and species of worms obtained, in the order of their importance and under their respective types, is given below :—

TYPES AND SPECIES OF PARASITIC WORMS FOUND IN SHEEP IN SCOTLAND.

Type.	Species.	Location.
Flukes	Fasciola hepatica	Liver.
	Dicrocœlium dendriticum	Liver.
Tapeworms	Moniezia expansa	Small intestine.
	Cysticercus tenuicollis	Mesentery.
	Cœnurus cerebralis	Brain and spinal cord.
	Echinococcus granulosus	Liver.
Roundworms	Ostertagia circumcincta	Fourth stomach.
	Nematodirus filicollis	Small intestine.
	Trichostrongylus vitrinus	Small intestine.
	Ostertagia trifurcata	Fourth stomach.
	Hæmonchus contortus	Fourth stomach.
	Cooperia curticei	Small intestine.
	Trichostrongylus colubriformis	Small intestine.
	Strongyloides papillosus	Small intestine.
	Chabertia ovina	Large intestine.
	Trichuris ovis	Cæcum.
	Trichostrongylus axei	Fourth stomach.
	Dictyocaulus filaria	Lung.
	Bunostomum trigonocephalum	Small intestine.
	Muellerius capillaris	Lung.
	Nematodirus spathiger	Small intestine.
	Capillaria longipes	Small intestine.
	Cooperia oncophora	Small intestine.
	Protostrongylus rufescens	Lung.
	Œsophagostomum venulosum	Large intestine.
	Cooperia punctata	Small intestine.
	Ostertagia ostertagia	Small intestine.

THE LIVER-FLUKE (*Fasciola hepatica*).

The liver-fluke (Fig. 1) is a greyish-brown, flat worm about 1½ inches long, which lives on blood in the bile ducts of the liver of sheep, cattle, horses, pigs, rabbits, and various other animals. It produces the disease known as liver-rot. It is essentially a disease of marshy areas, and during a wet season the losses may be very high in fluke-infested areas.

Symptoms.—At first sheep tend to improve in condition, apparently as a result of a stimulation of the liver. Later, however, they lose weight. The membranes of the eye and mouth become pale; the sheep become weaker, feed badly, and the wool loosens. As the disease progresses dropsical swellings usually appear under the jaws ('bottle-jaw') and the abdomen. The animals may live for two or three months, and finally die if subjected to unusual exertion or very cold weather. If they survive till the spring, they tend to throw off the effects of the disease and gradually recover. A safe diagnosis can be made by killing a sick sheep, slitting open the bile ducts of the liver, and discovering the flukes.

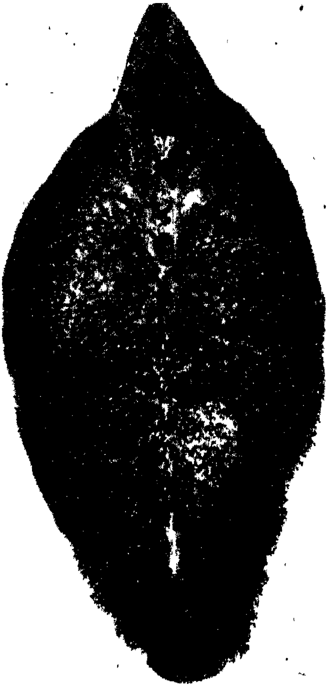

Fig. 1.—*The Liver-fluke,* Fasciola hepatica, *which causes the well-known liver-rot disease of sheep.* × 2½.

Life-cycle.—The adult fluke in the bile ducts of the liver produces thousands of eggs, which are passed out on to the ground in the droppings. Eggs which fall on ground with sufficient moisture hatch in a few weeks, and liberate minute forms capable of swimming in water. Should these forms meet with the right kind of water-snail within a period of twenty-four hours they bore into the snail's body, and there develop and multiply. In due course the progeny leave the snail and again swim in the water, finally coming to rest on grass blades, where they form a protective shell. They are now just visible to the naked eye as small whitish spots, and in this quiescent form can remain alive for many months. When swallowed by the sheep the young fluke escapes into the gut and bores through the wall to reach the liver, where it matures.

Treatment.—Effective, and the most convenient, treatment is by means of gelatine capsules containing carbon tetrachloride. In many districts it is customary to dose in mid-October, and again a month later, but repeated dosing may be necessary from September to February, during which time the snail gives off the young flukes which attack sheep.

Certain precautions should be taken :—

> All feeding of concentrates should be discontinued *at least* one week before treatment.
>
> Sheep should not be dosed in very cold, inclement weather.
>
> Where there is any likelihood of mineral deficiency a bone-meal lick should be provided.
>
> It is undesirable to treat ewes in advanced pregnancy, although it has been done in emergency.
>
> Rough handling or any form of marked exertion should be avoided for forty-eight hours owing to the delicate state of the liver following dosing.

Prevention.—An obvious preventive is the destruction of the snails, which can be done either by proper drainage of the land or by chemical treatment. Copper sulphate or 'bluestone' is the most suitable chemical to use. Mix one part of finely ground bluestone with four parts of sand and broadcast by hand at the rate of 20 lb. bluestone per acre. When practicable all marshy areas should be efficiently drained. With clear springs, a ditch should be dug to carry water away, so that it no longer spreads out to form a bog, but is drained straight down to the nearest permanent channel.

Rabbits should be destroyed, since they are susceptible to fluke and capable of keeping the infection going. Deer also are carriers of the disease and should not be allowed to become numerous.

TAPEWORMS.

Tapeworms are flat, segmented forms with a small head provided with suckers, which enable them to hang on to the gut lining. The segments towards the end, which are full of eggs, gradually break off and are passed out on to the ground, where they are readily seen on the surface of freshly passed droppings. Some kinds of tapeworms measure only a fraction of an inch, while others, such as the common tapeworm, may grow to a length of 20 feet and more.

THE COMMON TAPEWORM (*Moniezia expansa*).

The common tapeworm (Fig. 2), like all other tapeworms, lives in the small intestine, feeding on partly digested food.

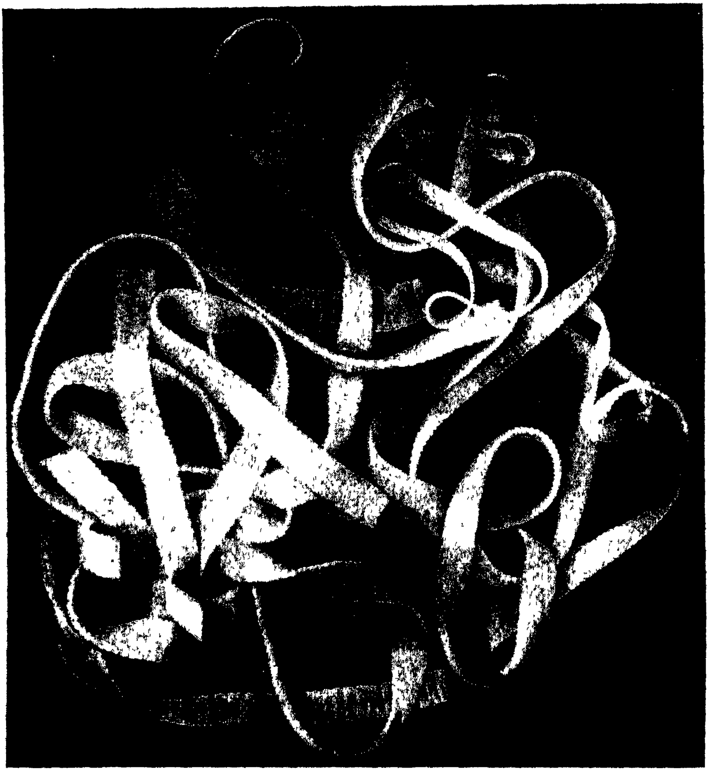

Fig. 2.—*Tapeworms,* Moniezia expansa, *from the small intestine of a six-weeks-old lamb.*

This is the commonest tapeworm in sheep, and large numbers have been found to occur in lambs without causing serious effects.

In small numbers it would appear to cause little harm, but where heavy infestations occur lambs may become unthrifty and pot-bellied. Because of its large size most sheepmen tend to regard the common tapeworm as a particularly dangerous parasite; but the truth is that it is not so harmful as the numerous thread-like intestinal worms that are always present and which, on account of their small size, are frequently overlooked. Tapeworms should, therefore, not be held responsible for a lamb's poor condition until a search has been made for the presence of other worms or other more probable causes.

Life-cycle.—The ripe segments passed out in the sheep's droppings break up and the eggs are distributed over the grass and into the soil. They will not hatch, however, until eaten by a suitable intermediate host. For a long time the nature of the intermediate host remained a mystery, but recently it has been shown that grass mites are capable of acting in this capacity. The eggs hatch and develop into cysts inside the body of the mites, but complete development is impossible unless the infected mites are picked up by the sheep. These mites are active creatures, and some of them may crawl on to the udder and teats of the ewe when she is lying. It is thus possible for a lamb to become infested at its first suck. Reaching the stomach of the lamb, the mites are digested, and the larval tapeworms escape and grow to maturity in the small intestine.

Control.—The common remedy for tapeworms is a 2 per cent solution of powdered copper sulphate (bluestone), to which is added an equal quantity of commercial nicotine sulphate, 40 per cent (Black Leaf, 40). This is prepared by dissolving 8 oz. of copper sulphate in 2½ gallons of hot water, and then adding, preferably just before use, 8 fluid oz. of commercial nicotine sulphate, 40 per cent. It is important to note that this mixture should be prepared in an *enamelled* bucket and shaken thoroughly prior to dosing. This mixture will also destroy many stomach and intestinal roundworms, particularly the Twisted Wireworm (*Hæmonchus contortus*).

The dose for lambs under six months is ½ oz. The lambs should be separated from the ewes in the evening, dosed early the following morning, and starved for another two hours. In heavily infected pastures lambs should be treated from a month old, and the treatment repeated every three weeks until they are six months old. In lambs over six months, and in older sheep, the presence of tapeworms may be ignored.

BLADDERWORMS.

The sheep acts as an intermediate host of several tapeworms which in the adult stage occur in the dog. In Scotland sheep may become infested with three of these—namely, the Long-necked Bladderworm (*Cysticercus tenuicollis*), the Gid or Sturdy Bladderworm (*Cœnurus cerebralis*), and the Hydatid Bladderworm (*Echinococcus granulosus*). The latter is especially important, as it is the cause of a painful and often fatal disease in man.

The life-cycle is similar for all three bladderworms. Sheep become infested when grazing over ground contaminated with eggs from tapeworm segments passed by the dog. The eggs hatch in the sheep's gut, and the larval tapeworms are carried in the blood-stream to various parts of the body, where they develop into bladderworms. A bladderworm is a thin transparent ball of fluid containing the heads of future tapeworms, and when a dog eats one the heads are liberated, and develop into adult tapeworms in the dog's intestine.

THE LONG-NECKED BLADDERWORM (*Cysticercus tenuicollis*).

This larval tapeworm is very common in sheep in Scotland. It is found suspended in the abdominal cavity or attached to the outside of the gut or occasionally in the liver. A sheep becomes infested by swallowing eggs of the dog tapeworm, *Tænia hydatigena*. The larva enters the liver *via* the blood-stream, and then bores its way through the liver to enter the abdominal cavity.

This bladderworm has little effect on the health of the sheep even when present in large numbers. It is far too common, however, and its frequency shows how careless shepherds are in allowing their dogs to eat raw offal.

THE HYDATID BLADDERWORM (*Echinococcus granulosus*).

This parasite owes its importance to the fact that it can infest man as well as all domestic animals. In the latter it is seldom of much importance, but in man it produces a serious and sometimes fatal disease. Hydatid cysts (Fig. 3) have a firm wall and may grow to the size of a melon. They occur in many parts of the body, but chiefly in the liver and lungs of sheep, cattle, and pigs. Fortunately, as a result of meat inspection, the disease is now comparatively rare.

The adult tapeworm is not more than ¼ inch in length and composed of only three to four segments. It is, therefore, difficult to detect in dogs unless their excreta is examined with the aid of a microscope. Man becomes infested by swallowing the eggs passed by the dog. This may take place by direct contact with infected dogs, by drinking contaminated water, by eating unwashed vegetables (especially lettuce) contaminated with dog's excreta, and by handling sheep. In Iceland sheep are especially important as a factor in the spread of human infection; and it is interesting to note that women are more frequently infected than men. The reason for this is that the ewes which are kept near the farm are regularly milked by the women. The ground in the neighbourhood of the farm is contaminated by dogs, and the ewes are liable to have the wool soiled with tapeworm eggs, which are readily transferred to the hands of the women.

Proper control of the disease is of the utmost importance to human health, and for this reason every precaution should be taken to prevent its occurrence. Dogs should never be allowed to eat animal offal unless it has been cooked. The habit some shepherds have of allowing their dogs to feed on uncooked dead sheep is nothing short of a crime, for the same food could be used safely if cut up and boiled for a few minutes.

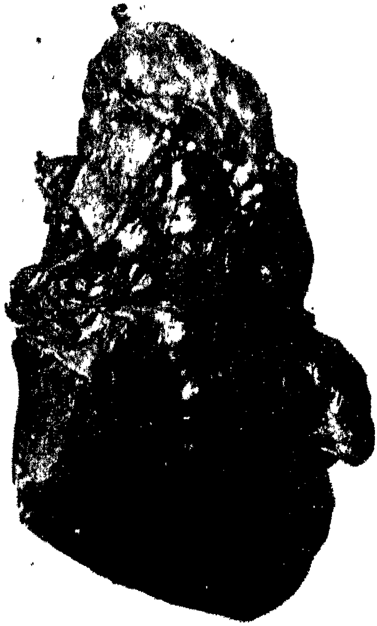

Fig. 3.—*Liver of sheep heavily infested with bladderworms of the tapeworm* Echinococcus granulosus.

It is a most dangerous tapeworm, since the bladderworm stage can develop in most mammals, including man.

Regular treatment of dogs for tapeworms is also an important factor in the control of the disease. Arecoline hydrobromide is the best drug to use. It may be given in tabloid form, or the tablets may be dissolved in water. The animals should be given no food for twenty-four hours before dosing, and they should be tied up until purgation has ceased. All excrement should be collected and burnt.

THE STURDY BLADDERWORM (*Cœnurus cerebralis*).

This bladderworm may grow as large as a hen's egg (Fig. 4) and contain over 400 tapeworm heads. It produces the disease known as sturdy or gid. The bladderworm occurs in the brain and spinal cord of sheep, but cattle, horses, and even man may become infested.

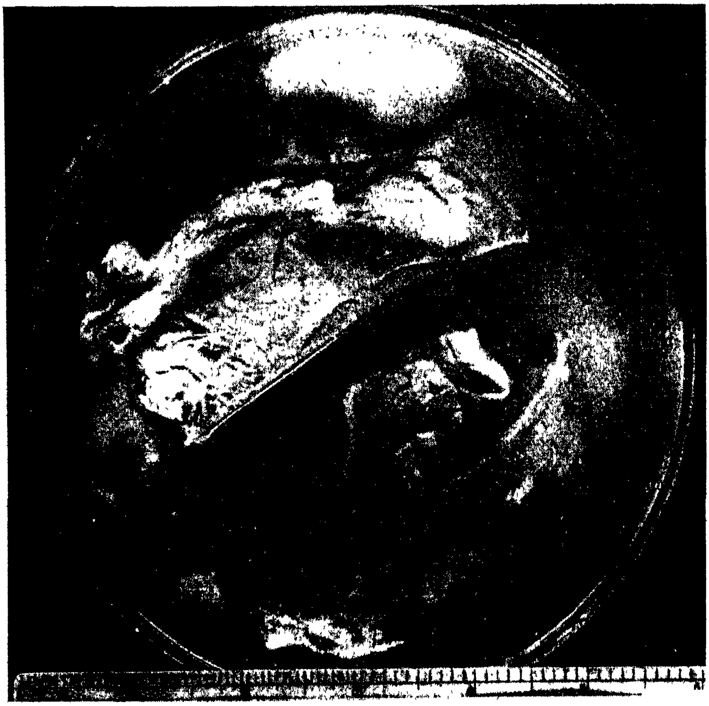

Fig. 4.—*Brain of sheep infested with a bladderworm of the tapeworm,* Multiceps multiceps, *which causes "Sturdy" or "Gid."*

This bladderworm contained a total of 436 tapeworm heads.

The signs of sturdy are well known to most sheepmen. Symptoms are not apparent until the bladderworm has reached a considerable size and exerts pressure on the brain. Its presence causes some sheep to stagger and go round in circles; others may walk blindly forward and show unusual sensitive-ness to noise. If the bladderworm appears on the spinal cord signs of paralysis are usually evident, the animal being unable to stand. It should be noted that certain other diseases, such as louping-ill, nasal bot, and some poisonous plants, cause similar symptoms. A post-mortem examination to discover the presence of the characteristic bladderworm in the brain or spinal cord will confirm suspicions of sturdy.

Prevention is on similar lines to that advised under Hydatid Bladderworm. Affected sheep can, with veterinary assistance, be cured by removing the bladderworm with special instruments. With a valuable animal such an operation might be worth while, but with commercial sheep the best plan is to send it to the butcher at the first opportunity. It need hardly be stressed that the crude method of piercing the skull with a knife or nail to burst the bladderworm is to be greatly deprecated.

LUNGWORMS.

There are two lungworms of importance—namely, *Muellerius capillaris*, which infests lung tissues ; and *Dictyocaulus filaria*, which is found in the bronchi. Both are parasites of mature sheep and are seldom found in young lambs.

THE NODULAR LUNGWORM (*Muellerius capillaris*).

The nodular lungworm is widely distributed in Scotland, and few sheep escape infection. It is found in the finer air-passages, and gives rise to greyish nodular areas, which can be readily seen at post-mortem (Fig. 5). It is not a serious parasite, and heavy infestations are often harboured by apparently healthy sheep. At times it may weaken the lung tissue to such an extent as to render it susceptible to bacterial infection. There are no definite signs of infestation, while cough and other pneumonic symptoms are usually absent.

Since there is no method known for treating the lung to destroy nodular lungworms, control must rely on preventive measures.

THE LARGE LUNGWORM (*Dictyocaulus filaria*).

This is a slender worm about 4 inches in length. It is widely distributed, and often occurs in sufficient numbers to cause serious losses in sheep. Generally speaking, a sheep will not show symptoms until the worms are numerous, but a great deal depends on the health and condition of the sheep.

Symptoms.—The first sign of lungworm infestation is frequent coughing. Later, as the air-passages become blocked with the worms and mucus, breathing is difficult. Heavily infested animals gradually lose condition, and may die within two months after infection.

Should any doubt exist as to whether coughing in sheep is due to lungworm, it is an easy matter to have one slaughtered and the lung examined. On slitting the air-tubes, the creamy-white worms will be readily seen. If the worms are counted and the number found to be less than fifty, the infestation need not be regarded as serious, since counts in the neighbourhood of this number have been found in apparently healthy sheep.

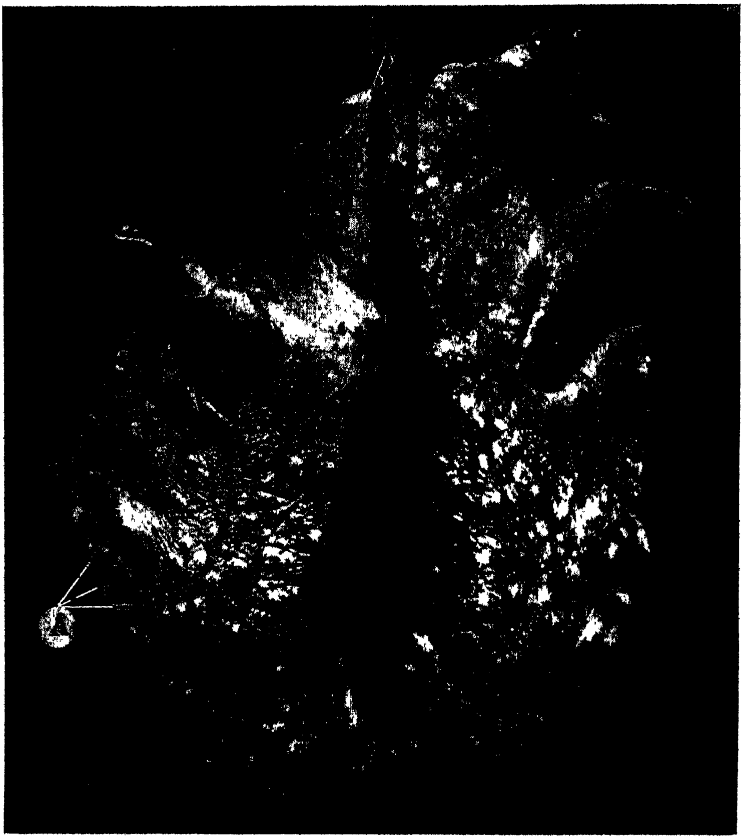

Fig. 5.—*Lung infested with* Muellerius capillaris, *a common species of lungworm in sheep.*

The worms produce greyish nodules (A) consisting of necrotic masses.

Life-cycle.—The eggs when laid contain active young worms, and these hatch either in the air-passages or, if coughed up and swallowed, in the gut of the sheep. The larvæ grow into the infective stage in about a week, the exact time of development depending mainly on the temperature. The infective larvæ can resist dry conditions and are able to penetrate the skin. They will climb on to grass in dewy weather, retreating to the soil when conditions become dry. The greatest number of larvæ are picked up by the sheep when the weather is dull and humid. On reaching the gut of the sheep, the infective larvæ bore into the gut wall and enter the lymph stream which carries them to the lungs. Here they develop into adult worms. An interesting feature in the life-cycle of this parasitic worm is that lambs may become infected before birth.

Control.—In spite of the numerous drugs which have been tried, medicinal treatment for lungworm is still unsatisfactory. Sometimes a marked improvement will be obtained if drugs are given to reduce the level of stomach and intestinal worm infestation. Indeed, sheep are often treated for lungworm infestation when their backward condition is due mainly to stomach and intestinal worms. In every case of suspected lungworm infestation a post-mortem examination should be made, and the worm burden in the gut ascertained as well as that in the lung. Until a more effective drug has been found, therefore, the best plan is to dose with phenothiazine. Afterwards the sheep should be given a supplementary diet of concentrates and removed to clean, fresh pasture. It has been adequately demonstrated that, except in very bad cases, sheep when well fed and kept under good conditions will rapidly throw off the effects of lungworm infestation and improve without drug treatment. Thus the common Scottish practice of folding on turnips after aftermath is an important limiting factor.

STOMACH AND INTESTINAL ROUNDWORMS.

As their name implies, these parasites are round, thread-like worms which taper at both ends. In size they vary from $\frac{1}{10}$ inch to $1\frac{1}{2}$ inches long. A total of twenty-one species have been obtained from the gut of sheep in Scotland, but less than half this number are believed to cause serious injury.

In the majority of cases of stomach and intestinal roundworm infestation investigated by the writer, the lesser stomach worm (*Ostertagia* spp.) has been obtained in very much larger numbers than any other species, and it is now held to be the most important roundworm in young sheep in Scotland. The twisted wireworm (*Hæmonchus contortus*), although common, seldom occurs in large numbers, and from an economic standpoint is not so important as the lesser stomach worm.

Next in importance are *Nematodirus* spp. and *Trichostrongylus* spp., both occurring in the first 20 feet of the small intestine. They are small, slender worms, and extremely difficult to detect unless a careful examination of the bowel contents is made. They appear to produce the same type of injury as the lesser stomach worm, and, together with this parasite, undoubtedly play an important part in bringing about symptoms of parasitic gastritis.

Fig. 6.—*Lining of the large intestine infested with* Chabertia ovina.

This roundworm is a common parasite of both young and old sheep.

In the large intestine *Chabertia ovina* is the most important roundworm, particularly in older sheep. It hangs on to the lining of the gut (Fig. 6), sucks blood, and produces a thickening of the bowel and intestinal derangement.

Only on one occasion has the whipworm, *Trichuris ovis*, been obtained by the writer in sufficient numbers to cause injury to the bowel wall.

All other species occur in relatively small numbers, and therefore do not call for special comment.

HOW ROUNDWORMS MULTIPLY.

The life-cycle is similar in all species. The adult female lays thousands of eggs, which find their way to the ground in the droppings. In from one to two days these hatch out into first-stage larvæ, which feed on the droppings. These first-stage larvæ must pass the next two stages of their growth on the ground before they are capable of infecting sheep. The time taken to reach the infective stage depends on conditions of temperature and moisture, but, generally speaking, it is about ten days.

The infective stage is covered by a protective sheath, enabling it to resist adverse climatic conditions such as cold and dryness. It does not remain at rest in the soil, but has the power to climb up blades of herbage when sufficient moisture is present, and to return to the soil again during dry, sunny weather. When picked up by a sheep it becomes attached to, or burrows into, the lining of the gut, and develops into a male or a female worm.

There are several important practical points in this life-cycle. In the first place, roundworms cannot multiply inside the sheep. Every worm found in a sheep must enter with its food, and, to increase their chances of doing so, the infective larvæ climb as high up the herbage as its structure and the external moisture will allow. On a dewy morning hundreds of them may be found on sheeped pasture swimming in the drops of moisture. Secondly, the rate at which a sheep picks up worms depends on the extent to which the field becomes contaminated with sheep excrement—the greater the soiling, the higher the intake of worms. Thirdly, if the infective worms are eaten by cattle, horses, or other animals, they will be destroyed, since they can survive and develop only in sheep. Fourthly, although the infective larvæ can remain alive for a long time on the ground in the absence of the sheep, the period is not indefinite and varies according to climatic conditions, but it is generally considered to be not longer than twelve months.

SYMPTOMS AND DIAGNOSIS OF STOMACH AND INTESTINAL ROUNDWORM INFESTATION.

Although it is quite simple to demonstrate the presence of roundworms in the fourth stomach and intestines of sheep, it is extremely difficult to decide whether they are actually causing disease. Indeed, of all the troubles that occur in sheep, none presents more difficulty than this, for the reason that the number of worms which may be regarded as sufficient to injure the health of an animal cannot be defined, and varies with many factors.

The point which must be kept in mind is that all sheep have worms, and that fat lambs will harbour even up to 7000 stomach and intestinal roundworms without showing visible signs of ill-health. Every new-born lamb is faced, therefore, with the twofold task of eating sufficient food to maintain growth and to resist the harmful effects produced by the worms taken in with its food. Time has established a balance between the sheep and its burden of parasitic worms. This balance may be upset in two ways, either by an abnormal increase in the number of worms or by a lowering of the resistance of the infested sheep. Quite often both things happen together, as in the autumn when pastures become grossly infested with worms and lambs lose condition through the decreasing value of the pasture.

Fig. 7.—*Greyface lambs, nine months old, showing symptoms of stomach and intestinal roundworm infestation.*

The usual sign of roundworm infestation in lambs (Fig. 7) is that they are not thriving as well as they should, giving due consideration to breeding, feeding, and management. They appear to eat plenty, but do not put on weight. They handle badly, lack vigour, and their coats are dry and without bloom.

It should be noted that other diseases give rise to symptoms not unlike these. For example, lambs suffering from nutritional deficiencies, such as Pine, tend to lose flesh and bloom in much the same way. Any attempt, therefore, to diagnose worm infestation in a flock without carrying out an ante- and post-mortem examination of two or more selected specimens and ascertaining the numbers and species of worms present is liable to error. To save time some workers base their diagnosis on the number of worm eggs passed in the fæces of affected animals. This method, however, is unreliable, as the number of eggs passed by an animal at any particular time varies within wide limits in the same animal. No farmer should undertake these jobs himself, as it requires special equipment and training. He can obtain assistance from his local veterinary surgeon or from the Veterinary Department of his local Agricultural College.

If the average worm count is well beyond that commonly met with in healthy sheep of the same age, and the grazing history and management of the sheep are such as to produce conditions favourable to the development of the worms, then the probability of gastro-intestinal worm disease being present must be accepted.

METHODS OF CONTROL.

Worm Medicines.—While the use of a cheap and safe drug would be the ideal method of dealing with the worm problem and the one favoured by most sheepmen, it can be definitely stated that, with the exception of carbon tetrachloride for fluke and copper sulphate and nicotine sulphate for the twisted wireworm, the position with regard to drug treatment is still unsatisfactory. It is true that the recently introduced drug, phenothiazine, has given some remarkably good results, and, for a time, appeared to be the answer to the problem of stomach and intestinal roundworm infestation. However, some investigators have recently obtained very indifferent results, and it appears that this drug requires further experimentation before its use on a wide scale can be recommended. More information is required on the chemical changes which it undergoes in the animal's food canal, its effect on the blood and metabolism, and the best method of administration.

The writer's experience with this drug has not been wholly satisfactory. Against the large bowel worm, *Chabertia ovina*, for instance, large doses of up to 30 grammes, or 0·5 grammes per lb. body weight, gave excellent results, but doses of 10 grammes, or 0·25 grammes per lb. body weight, had no effect on stomach worms in healthy sheep. In some cases, however, where the infestation was heavy, a reduction in the worm burden was obtained, a result which supports the finding that phenothiazine is more effective in heavy than in light infestation.

One explanation for the poor results obtained by the use of drugs against parasitic gastritis in sheep in Scotland is probably to be found in the fact that the chief worm responsible for the trouble, the lesser stomach worm, when first reaching the stomach burrows into the lining, thereby escaping the effects of the drug. Fig. 8 shows a section of the fourth stomach of a sheep with a lesser stomach worm showing beneath the lining. No matter how efficient a drug may be, it cannot be expected to remove worms from the gut at this stage of their development.

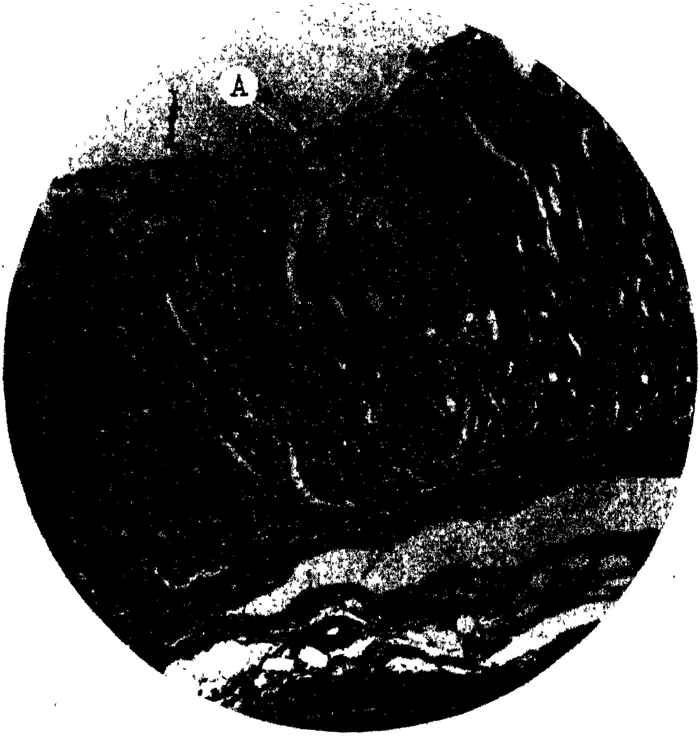

Fig. 8.—*Section of the lining of the fourth stomach of a sheep infested with Lesser Stomach Worms,* Ostertagia circumcincta.

A worm (A) is shown buried underneath the surface.

Another factor operating against success with drugs is the fact that they have no lasting effect. They will only destroy those worms which are in the gut at the time of treatment. Consequently newly dosed sheep, if put back to graze on worm-infested pastures, will require repeated dosing until clean grazing is provided.

It should be remembered, too, that all worm medicines are poisons, and liable to injure the health of sheep if given in an improper manner or in quantities greater than the prescribed dose. Until some reliable medicinal treatment is available, it cannot be too strongly emphasised that the obvious aim of the flockmaster must be to prevent heavy worm infestations rather than to rely on the use of drugs.

Overcrowding.—Under existing conditions, when grass becomes plentiful on sheep farms, it is usual to increase the stock, and therein lies one of the chief reasons for the widespread incidence of roundworm infestation ; for nothing is more favourable to the multiplication of worm parasites than overcrowding. Sheep roundworms have remarkable egg-laying powers, and a heavily worm-infested sheep may pass up to 40,000,000 eggs per day. When a whole flock is heavily infested the extent to which the ground becomes contaminated is amazing. Furthermore, the increase of worm eggs on a pasture is much greater than it first appears, because worms tend to increase as the square of the number of animals. In simple language this means that if the number of sheep per acre are trebled, each sheep is exposed to three times the previous risk of infection, and each acre of grass becomes infested with, not three times, but nine times the original number of worms.

Mixed Grazing.—One of the most interesting features in the relationship between a sheep roundworm and its host is that, with the exception of the goat, it cannot survive in another animal. This means that, if horses or cattle are put to graze on pasture infested with sheep worms, the worms picked up by these animals will be destroyed. By grazing cattle or horses along with sheep, therefore, both a reduction in the number of sheep worms and an improvement in the grass will take place simultaneously ; for it is a golden rule in grassland management that grass should not be grazed by one type of animal. Moreover, the same thing applies when older sheep, such as ewes and hoggs, are allowed to graze with lambs. Mature sheep can resist further infestation, so that, where there is danger of a pasture being heavily contaminated, it should be grazed by them, thus leaving the cleaner pasture to the lambs.

Choice of Seed Mixture.—According to Dr E. L. Taylor, Veterinary Laboratory, Weybridge, pastures, particularly those rich in wild white clover, are more liable to produce wormy sheep than those with an open sward. Wild white clover is more favourable to the upward movements of the infective larvæ than are grasses, so that a pasture rich in wild white clover will allow a greater intake of larvæ. Drought and sunshine are particularly lethal to the infective larvæ, and, because of the greater moisture-keeping qualities of clover, the larvæ have a much greater chance of survival. This may explain to some extent the commonly held view that lime increases the incidence of roundworm disease because of its beneficial effect on clover.

Another point of some practical importance in connection with the movements of the infective larvæ on pasture is that sheep grazing bare pasture are liable to pick up more worms than those on rich pasture. This is explained by the fact that the bulk of infective larvæ tend to concentrate near the ground, so that the closer the animal grazes to the ground, the greater the risk of infection. In view of their greater susceptibility to worm infestation, lambs should be kept off bare pastures.

Type of Soil.—The type of soil undoubtedly plays some part in the incidence of roundworm infestation. When the excrement of worm-infested sheep is trampled into sandy soil the conditions for egg-hatching and development are much more favourable than in clay soil, and this probably explains why certain districts are more liable to produce wormy sheep than others. In sheep districts with open sandy soil, therefore, there is a greater need for reducing the number of sheep per acre than on heavy soils. However, clay soils, if badly drained, will tend to increase parasitic worms, in view of the absence of dryness as a limiting factor in the development of the larvæ.

Grass Silage.—The practice of cutting pastures frequently for the purpose of making grass silage has an important bearing on the prevention of worm infestation, since the infective larvæ are removed from the pasture in very large numbers and destroyed. On several grass silage farms, where the grass is cut as often as three times in a season, there is evidence that the sheep are much healthier, largely through the reduction of the number of infective worms. The grass is cut as close to the ground as possible, and since the most of the worms are concentrated near the ground a large proportion of them are removed from the field for ever.

Dressing Pastures.—Many attempts have been made to destroy the infective larvæ on pastures by applying heavy dressings of lime, kainit, calcium cyanamide, salt, and other substances. The writer explored the possibility of salting pastures (up to one ton of rock salt per acre) against stomach worm larvæ, but the results obtained were not significant. The protective sheath covering the infected larvæ has so far proved resistant to all chemicals applied in quantities which did not destroy the grass.

Rotational and Progressional Grazing.—Since relatively few stomach and intestinal roundworms can develop from the egg to the infective stage in less than ten days in our Scottish climate, it follows that any system of grazing whereby the sheep are moved up to clean pasture every ten days should, theoretically, produce worm-free sheep. The writer tested this theory by grazing two lots of ewes and lambs on worm-free pasture. One lot was put into half the field and allowed to graze over the whole, while the other lot was allowed to graze only one-tenth of the other half at one time, the ewes and their lambs being changed to clean sections at ten-day intervals. Both lots of lambs were selected as nearly alike as possible with respect to age, weight, and condition.

At the end of the experiment the lambs were slaughtered, and the carcases sold and the fourth stomachs retained for a count of the worms present. The results showed that progressional grazing was efficient to the extent of reducing twisted wireworm and lesser stomach worm infestation, 99·2 per cent and 80·8 per cent respectively, compared with the non-progressional group.

How far progressional grazing can be put into practice depends on many circumstances—namely, labour and the nature of the grazing available. With ordinary pastures it probably would not pay, but, where rich aftermath is to be eaten by fattening sheep, there is nothing to prevent them being folded on it instead of allowing them to wander over and foul the whole field at one time. It should be clearly understood, of course, that they must not be allowed to graze over what they have already eaten. This can be reserved for older sheep or cattle.

The advantages of rotational grazing whereby sheep are made to graze over as many fields as possible is also worthy of consideration. The more fields available for grazing, the better. By grazing four or more fields in rotation, each one in turn is rested, and a large proportion of the infective larvæ will have lost their infective power by the time the sheep have returned.

Resting Pastures.—Since the infective larvæ gradually die off in the absence of their host, it follows that the degree of worm infestation on any pasture will be greatly reduced if the sheep are kept off it for a time. The longest period the larvæ can live is about twelve months, but most of them die before this time. Indeed, there is evidence that the majority of them die within a few weeks, the death-rate depending on the degree of dryness. Hence, if pastures are kept free of sheep at certain intervals, the degree of infestation will be greatly limited and the pasture maintained in a much healthier condition. Where pastures are wet or badly drained, dryness as a limiting factor in the longevity of the infective larvæ does not, of course, exist, and it is for this reason that wet pastures are invariably unhealthy for stock, and should be avoided at all costs for the grazing of young animals. In Russia it is the custom to issue special weather reports to farmers with information on the length of time it would appear to be safe to keep animals on pastures without danger of increasing internal parasitism.

It should be mentioned that if the pasture tends to become too rank during the intervals when it is kept free of sheep, it can be grazed with cattle or topped with a mower and made into hay or silage. Whatever method is adopted it cannot be too strongly emphasised that the practice of putting sheep on a field for the whole summer is to be condemned, for, apart from the fact that it encourages a high degree of worm infestation, it is bad for the grass.

Ploughing-up Pastures.—Where pasture has become completely worn out or 'sheep-sick,' no better advice can be given than that it should be ploughed up and put into crop. If after three or four years' cropping it is sown out again it can be safely assumed that it is worm-free, for the infective larvæ will have died during the long interval. In those cases, however, where a worm-infested pasture has been ploughed and sown out in the same season it is still dangerous for sheep, as the infective larvæ are capable of migrating on to the soil surface and on to the blades of the new grass. Where sheep are concerned, therefore, no pasture should be ploughed up and resown until it has been cropped for at least two years.

Value of Good Feeding.—One of the most important points to remember is the extent to which good nutrition will enable animals not only to resist the harmful effects produced by intestinal worms, but also increase their power to expel worms recently picked up.

Dr Allan Fraser, Rowett Research Institute, and the writer confirmed this by experiment. We took thirty-two Half-bred lambs off their mothers and fed them inside concrete pens (sawdust used as bedding) on worm-free foods. At three months old the lambs were divided into two groups of equal weight. One group was given a good diet, the other a poor one, and at the age of four months the average weight of the poorly fed group was 60 lb. and the well-fed group 84 lb. At this point all thirty-two lambs were grazed on naturally infected pasture—*i.e.*, pasture which had been heavily sheeped. At the end of forty-six days the lambs were slaughtered and the carcases sold, while the fourth stomachs were kept and a count of the worms made. On an average the poorly fed lambs contained three times the number of stomach worms compared with the well-fed group. This shows clearly how good feeding can be a factor of the highest importance in keeping lambs free of worms.

Not only does good nutrition decrease the number of worms which gain a footing, but it also increases the sheep's ability to overcome poisons given off by the worms. Some elements in the diet have a greater effect than others in helping to build up successfully a sheep's resistance. For example, anæmia is a notable sign of worm infestation, and the importance of iron in the food is very great. Cobalt and copper are also important, and it has been shown that, in soils deficient in these elements, the health of the sheep is impaired to such an extent that it has little or no resistance to even a moderate worm infestation.

There is no question that losses from stomach and intestinal roundworms are influenced to a large extent by nutritional conditions. Where losses have occurred the usual story is that the lambs did well until after weaning or when the grass began to 'go off.' Both point to a sudden drop in the level of nutrition, and both very often happen at the same time. A heavy worm burden is not difficult to resist when food is plentiful, but, when the reverse is the case, resistance breaks down and the animal loses condition.

Every effort should be made to maintain the level of the diet throughout the animal's young life. The farmer should not wait until signs of worm infestation have appeared before doing anything about it. A supplementary feed given as soon as the natural food begins to deteriorate will prove the best and cheapest preventive in the end. This is a most important point, because where losses from worm infestation have already begun it is much more difficult to check it with supplementary feeding. The animal is too weak to benefit from the extra food and it dies from exhaustion. Under such conditions the best plan is to shed out the worst lambs and fold them, as early as possible, on to a root crop such as turnips, and give them box feed in addition. To leave them grazing with the top lambs is merely inviting further trouble, since it leads to gross contamination of the pastures and exposes the good lambs to a greater risk of infection.

In conclusion, the writer would venture to suggest that if the nutrition was maintained at a satisfactory level throughout the first six months of a sheep's life, losses from stomach and intestinal roundworm infestation would cease to be a problem.

ACKNOWLEDGMENTS.

The worm survey was carried out in collaboration with the Rowett Research Institute under a grant from the Agricultural Research Council. The writer gratefully acknowledges his indebtedness to Mr John C. Grant, Lecturer in Veterinary Hygiene, North of Scotland College of Agriculture, for helpful criticism; to those County Agricultural Organisers who supplied the names of breeders of commercial sheep; and to all those farmers who willingly gave their sheep for ante- and post-mortem examination.

THE MOLE.

ITS LIFE-HISTORY, HABITS, AND ECONOMIC IMPORTANCE.

By R. STEWART MACDOUGALL, M.A., D.Sc., LL.D.

MOLES belong to that section of mammals—the animals that suckle their young—known as Insectivora. The only other British representatives of this section are the Shrews and the Hedgehog. In point of geologic time the mole is a very ancient creature, a primitive type of mammal that has managed to survive in the struggle for existence by the adoption of a subterranean life, and so not coming into competition with the later higher mammals. In comparison with these higher types the brain of the mole is small and simple; the cerebral hemispheres [1] are smooth, not convoluted.

The mole-family Talpidæ is not rich in species, but it has a wide distribution, from Britain eastwards to Thibet and over America from east to west.

The first mention of the mole in European literature is some 2000 years ago. In the years that follow, references to the mole are few and indefinite, but become more frequent from the twelfth century onwards. Legend continued active concerning the mole, but towards the end of the eighteenth century and the beginning of the nineteenth more trustworthy accounts, based on observation, were published. About 1798, Le Court, an interested and knowledgeable mole-catcher in France, had made many observations, and he communicated these to Cadet de Vaux, who incorporated them in his published work on the mole and its habits.[2] Geoffrey Saint-Hilaire, like de Vaux a zoologist, also made use of Le Court's observations in his publication on the natural history of mammals.[3]

The underground life of the mole, working as it does in the dark and giving little opportunity for observation above ground, makes study difficult. Hence some fanciful stories, as well as confusing and contradictory statements, by quite honest but unskilled observers. The mole's nervous unrestfulness does not help. Mining, shovelling aside the soil, throwing up mole-hills, making the Fortress, excavating the nest cavity and preparing the nest, hunting, feeding, fighting, loving—all is done at top speed and most of it out of sight. The problem of inquiry and proof of points that still need clearing up is accentuated by the difficulty of keeping the animal for any length of time in captivity.

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[1] The cerebral hemispheres or fore-brain are the seat of intelligence, and in the higher mammals they are not smooth, but show complicated folds or convolutions.

[2] 'De la Taupe, de ses mœurs, de ses habitudes et le moyen de la detruire.' By Cadet de Vaux in 1803.

[3] 'Cours de l'histoire naturelle des Mammiferes.' By Saint-Hilaire in 1820.

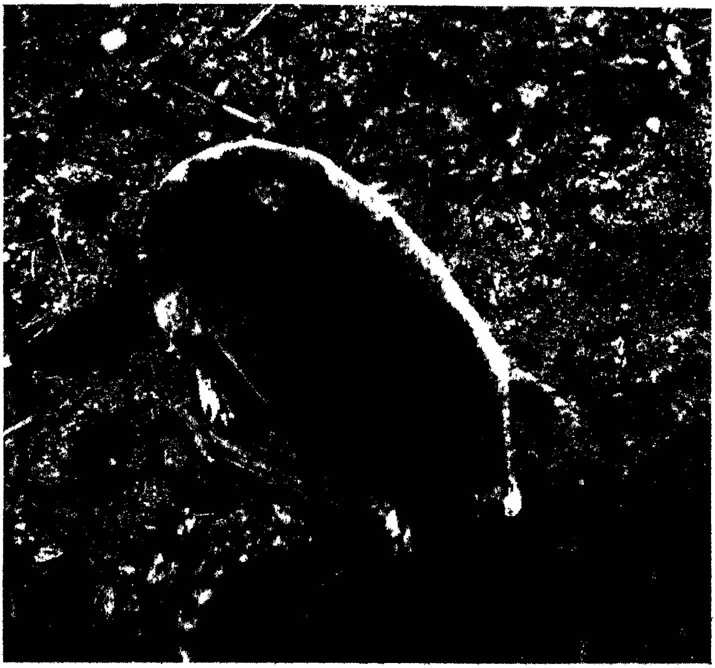

Fig. 9.—*The Mole* (Talpa europœa).

With acknowledgment and thanks to Miss Frances Pitt.

There is only one species of mole in England, Scotland, and Wales—viz., *Talpa europœa.* There are no moles in Ireland. The runs and mole-hills or 'heaves' of our mole are known from the seashore to over 2000 feet up the mountains. Evans [1] found their hillocks at 1700 feet in the Pentland Hills and still higher on the Ochils.

Commoner in its old habitats to-day, the mole has extended its range in Scotland, north to Caithness and to the western islands. In 1905 it was recorded from Campbeltown in Argyllshire, and the old prophecy comes to mind that "when the mole reaches the Mull of Kintyre the Campbells will be driven from their estates." The mole has also penetrated the promontory of Ardnamurchan, concerning which an old Gaelic seer foretold that "once the Point of Ardnamurchan was reached the end of the world would be near." While moles are more abundant all over, they are found in excessive numbers in some years in cultivated districts.

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[1] 'The Mammals of the Edinburgh District,' 1892. By William Evans.

The farmer by bringing new land into cultivation, with the consequent improvement in soil fertility, attracts and thereby increases the numbers of animals dependent on soil fertility. Among the favoured ones is the earthworm. The mole has increased in numbers with the abundance of its favourite food—the earthworm. "Where the carcase is there shall the eagles be gathered together."

As subsidiary factors in the increase in the numbers of moles we should keep in mind the loss of importance of the old trained mole-catcher and his industry and also the vagaries of fashion. Moleskin caps, waistcoats, capes, coats, slippers have gone out of fashion. The call by the Board of Trade for 10,000,000 skins (winter and spring, 1940-41) would, in more favouring conditions, have made surer the likelihood of maintaining the export trade in moleskins with United States and South America, a branch of export trade well worth saving.

It may be added here that the shortage of experienced mole-catchers and the lack of labour employed on other work will mean a considerable increase in the number of moles.

THE COMMON NAMES OF *Talpa europæa.*

In Scotland the mole is known as the mowdiewarp—the name means thrower up of mould or earth—or the Blind Mowdy or Old Mowdy of our school-days. The Gaelic name is Uireach (burrower in the earth). In England an old name is moldiwarp, a word appearing in the names of several English villages. Old English names wont, woont, 'oont still persist in the South of England.

DESCRIPTION OF THE MOLE.

The mole measures five to six inches in length of head and body, with a tail of just over an inch. The fur is velvety-black, tending to brown below; shades vary somewhat according to the angle from which the fur is viewed. Colour variations are not uncommon—greyish, yellow, cream-coloured, pale with a dark line down the middle of the back. Albinos are also found.

The mole spends most of its life underground in tunnels and in a dwelling made by itself. The animal is an outstanding example of how habit can mould structure. Arthur Thomson named it "a bundle of fitnesses," and the reader will note the fitnesses in the description that follows.

The body is cylindrical in form. The fur is set perpendicularly, not ruffling in the various movements of the animal; it is short and close, hinders the dust from reaching the skin, and is easily cleaned by the animal. The head is wedge-shaped. The wide-cleft mouth lies under the head and carries forty-four teeth, the dentition being :—

$$\frac{3}{3} \qquad \frac{1}{1} \qquad \frac{4}{4} \qquad \frac{3}{3}$$

—viz., 3 incisors, 1 canine, 4 premolars, and 3 molars on each side above and below. The incisor teeth are chisel-edged; they show no marked difference in size. The upper canines are long and have sharp points; the lower canines resemble the incisors. Barrett-Hamilton notes that the first premolar is elongated, larger than the lower canine. The crowns of the molar teeth are divided into sharp tubercles. The teeth are markedly those of an animal which feeds on a carnivorous diet. The carnivorous diet is further emphasised by the short intestine. The head is continued in front into a slender sensitive snout with the downwards-pointing nostrils at its tip. The pliant snout is strengthened by a bone and has strong muscles at its base; the snout is of service as a probe and it also assists in boring. The mouth can be tightly closed by a fold of skin from the upper lip, which covers the lower lip.

The eyes are mere little dots buried in the fur, and can be easily overlooked. There is no external ear to get filled with earth, and the openings of the inner ear passages can be closed against the entry of sand or earth.

A short muscular neck follows the head. The hands (fore-feet) are broad; there is, in addition to the thumb and four fingers, a sickle-shaped bone (the falciform bone) outside the thumb; the terminal joints of the fingers are elongated, and end in strong, sharp, nail-like claws. The spade-like hands do not point downwards, but are turned obliquely outwards, so that the action of the mole in tunnelling and shovelling has been described as 'swimming through the soil.' The chest is narrowed in front, and so the arms have more room to work. The handle of the spade—the lower and upper arm—is advantageously short. Fig. 10 shows the short joined radius and ulna of the lower arm, and the short wide humerus (the humerus is the bone that extends from the shoulder to the elbow) of the upper arm. Associated with these are the strong broad clavicles (collar-bones), the long shoulder-blades, and the crested sternum or breast-bone. Powerful muscles attached to these bones of the arm, shoulder, and breast girdle, along with the shovel-like hands, well earn for the mole Captain Mayne Reid's epithet of 'stout navvy'; and the work the mole does is really wonderful. The hind limbs are weaker and not modified for digging. The feet are not hairy, but are naked and, in colour, pinkish.

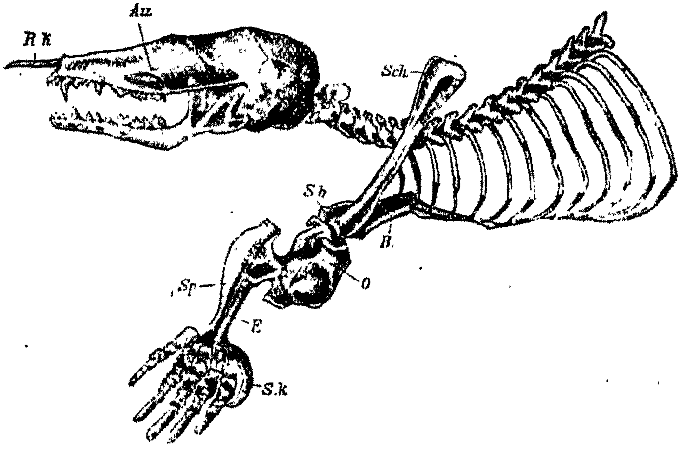

Fig. 10.—*Anterior half of the skeleton of the Mole, one and a half times natural size.*

Rk=Nasal cartilage. *Au*=Eye-socket. *Sch*=Shoulder-blade. *Sb*=Collar-bone (lateral view). *O*=Humerus. *Sp*=Ulna. *E*=Radius. *Sk*=The sickle-shaped bone or scraper. *B*=Breastbone.

With acknowledgment of the courtesy of A. & C. Black, Publishers, Soho Square, London.

SENSE ORGANS.

Smell, Hearing, and Touch are acute.

Smell.—By smell the mole finds its prey. That the mole-catcher believes in the mole's keen sense of smell is illustrated by the care he takes to rub his hands with soil before setting his trap or to rub the trap with a mole already caught.

Hearing.—There is no external ear like what is present in ourselves or in a horse or in a dog, and the inner ear passages can be closed against the entry of soil. The mole is extremely sensitive to vibrations in the soil, as notoriously also is its prey the earthworm.

Touch seems chiefly resident in the sensitive snout.

Sight.—In spite of popular opinion, the mole is not blind. Aristotle was right enough in saying blind if his reference was, as is quite likely, to the mole of Italy and South Europe, *Talpa cæca*, whose eyes do not reach the surface. Many are familiar with Shakespeare's lines in 'The Tempest':—

> "Pray ye tread softly that the blind mole may not
> Hear a footfall, we now are near his hill."

But our mole, *T. europæa*, is not blind, though its eyes have to be looked for. Geoffrey Saint-Hilaire demonstrated them, $\frac{1}{25}$ inch by less than that. Carl Hess,[1] after microscopic investigation, found that structurally the mole's eye had all the properties of seeing. These eyes cannot be of use in the darkness of the mole's underworld, but they are serviceable when the mole ventures above ground and when swimming (as it can in case of necessity), when the mole alters the position of the hairs that hide the eyes, and at the same time protrudes the eyes forward. Millais[2] writes: "The mole can make the hair which covers the eyes spread out and radiate so as to receive all possible light."

It remains puzzling that in experiment moles blundered into obstacles placed in their way, and did not seem aware of lights waved near them. But there are eyes and eyes. Meanwhile we may leave the mole's vision where Pope in his Essay on Man put it:—

> "What modes of sight between each wide extreme,
> The mole's dim curtain and the lynx's beam."[3]

THE MOLE'S DOMAIN.

We may write of this as consisting of a Fortress with its contained Nest for shelter and refuge, and in the case of the female for the rearing of the young; and in touch with this Fortress a number of Underground Tunnels or Galleries in use as hunting-grounds or for patrol. Hunting-runs vary in length according as the ground is rich or not so rich in food. The description below will show the mole an expert miner and a 'stout navvy.'

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[1] 'Zoologist.' 1890.

[2] 'The Mammals of Great Britain and Ireland.' By J. G. Millais.

[3] Lynx-eyed, of course, denotes keen vision.

The Lynx of old is a more or less fabulous animal credited in legend with being able to see through a wall. Some writers connect the word with Lynceus, one of the Argonauts who sailed with Jason in search of the Golden Fleece, and whose keen sight was such that he could see through the earth. The Lynxes of the present day are not very far away in relationship from our wild cat. There are two European species of Lynx, neither of which is remarkable for keen sight.

THE FORTRESS.

In the open or by a wood or hedgebank one meets with a hill of soil higher than the familiar mole-hill and of greater diameter. This is the mole's Fortress.

Saint-Hilaire's[1] plan of the Fortress published 120 years ago, with all its somewhat imaginary labyrinthine complexity and mathematical exactitude, continued to be copied into the books without first-hand observation till the real structure was revealed in the more exact work of Evans[2] and Adams.[3] These two naturalists dissected Fortresses and made drawings on the spot of what they found.

Some idea of the patience and thoroughness of Adams' work may be gathered from the fact that he explored more than 100 Fortresses and drew plans of them.

In making the Fortress the first thing the mole does is to hollow out a cavity just below the surface. Adams compares the cavity in size to a man's head or in shape and size to the old-fashioned cottage loaf. Into this cavity grass or leaves, or grass and leaves, are collected to form the nest. The nest quite fills the cavity, and, as Millais and others tell, it has no visible opening, but looks quite solid and compact. It is a cosy residence and shelter, and that of the female in the breeding season is the rearing place of the young.

The earth from the excavation has to be removed, and the mole for this purpose makes a tunnel or shaft to the surface, where the earth is thrown out.

From the bottom of the nest a tunnel is made, at first straight down and then taking a turn up to lead out of the Fortress. This is the bolt-run, by which the mole readily escapes in case of alarm or danger. Hunting-runs for a food supply may be made from the Fortress, and the earth from these and from the bolt-run has to be removed; it is thrown out over and round the nest. For the purpose of its removal a new tunnel may be driven to the surface; this additional tunnel sometimes branches to the outside of the Fortress from the original shaft, sometimes continues separately to the outside. These shafts for soil removal generally show a winding corkscrew-like pattern, with, it may be, here and there little blind branches. (See Figs. 11, 12, 13.)

According to the number of shafts in the Fortress and whether these remain unbranched, or branch and com-

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[1] Saint-Hilaire. Previously cited.

[2] William Evans in "The Mammalian Fauna of the Edinburgh District," 1892; and "The Mammals of the Edinburgh and Forth area" in the 'Proceedings of the Royal Physical Society,' 1906.

[3] Lionel E. Adams, B.A., "A contribution to our knowledge of the Mole" in 'The Manchester Literary and Philosophical Society Memoirs.' Vol. 47. 1902-1903.

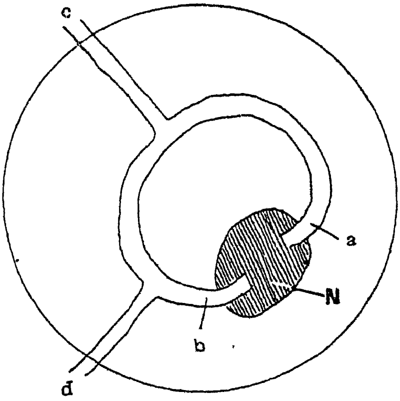

Fig. 11.—*Plan of tunnels of simple Fortress seen from above.*

a b—Tunnels made in excavating Nest. *c d*—Tunnels made in forming protecting run. *N*—Nest.

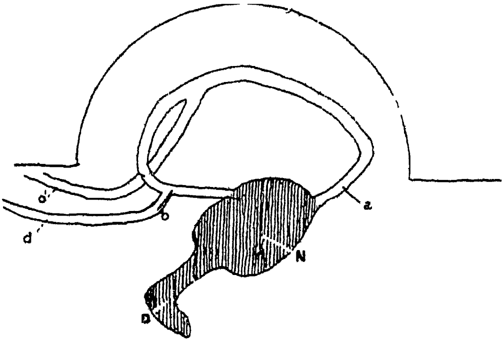

Fig. 12.—*Horizontal view of Fig.* 11.

D—Downshaft. *N*—Nest.

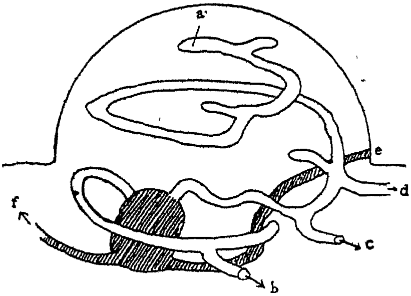

Fig 13.—*Vertical view of a complicated Fortress showing spiral gallery and some blind terminals.*

The tunnels used for ejecting earth from the nest cave and bolt-runs are generally corkscrew-shaped ascending from the Nest.

a—Apex of spiral gallery by which the soil was ejected. *b c d*—Outlets. *e f*—Two bolt-runs.

Figs. 11, 12 and 13 are by the courtesy of The Manchester Literary and Philosophical Society, from Lionel E. Adams' Article in the Society's Memoirs, Vol. 47, 1902-03.

municate with one another, a more or less complicated pattern may result. Some Fortresses are simple, others are complex. While there is a general resemblance, there is no uniform prearranged plan except in the case of the bolt-run. There are natural variations.

Adams, watching the erection of Fortresses from day to day, writes: "These galleries are the natural, incidental, and inevitable outcome of the work of excavating the nest cavity and of piling up the superincumbent mound." [1] The average height of a Fortress is 12 to 14 inches, with a diameter of 3 or 4 feet. Evans records a very large one in a mossy meadow which measured in the month of January 1897. 2½ feet and 8 feet in diameter.

Cadet de Vaux,[2] confirmed by Adams, says a new nest is made every year, and the new nest is often close to the last one, but always made with fresh material. The female makes a separate Fortress smaller than that of the male, and characterised by the absence of a bolt-run.

THE UNDERGROUND GALLERIES OR RUNS.

Outside of the Fortress the hunting-runs or tunnels extend in all directions. There is a more or less straight (in the cantonment of the mole there can be more than one) tunnel or high-road with solid-looking smooth walls. From this side-tunnels or hunting-runs branch off, marked in their course by the well-known mole-hills. The mole ranges these in its search for prey. When food fails these underground passages are extended to provide new hunting-ground, or an area richer in food may be selected. The depth of the main run varies with the nature of the soil. An average depth is 4 to 6 inches; it is in these runs the traps are laid. Such a highway may be traversed by a number of moles. I know of traps holding two moles, caught in moving along the highway in different directions.

In making the underground tunnels the soil is pushed aside by the hands. The hind feet help to push the body forwards. As the loose soil accumulates, the mole, having made a passage to the surface, pushes the earth out by the action of head and snout. The neck and shoulder muscles are very powerful. The hole by which the soil issues at the surface is about 2 inches in diameter. It is in this way that mole-hills are made.

Sometimes, in very light soils, the mole tunnels so near the surface that the movements of the animal can be seen, thus betraying the mole to its enemies; the mole's back may even show. In a very shallow run in light soil or in a seed-bed no mole-hills are thrown up; the eye may be caught by a line that makes the course of the mole visible.

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[1] Lionel E. Adams, B.A., 'The Manchester Literary and Philosophical Society Memoirs.' Vol. 47. 1902-1903.

[2] Cadet de Vaux. Previously cited.

The workings of the male and the female differ. In 1803 Cadet de Vaux[1] described the main runs of the male to be more or less straight with branches going off from them, whereas in the case of the female there was no very definite highway, but the tunnels were found to wind about in all directions. Adams in his research verified this.

When Moles come Aboveground.

At breeding-time the mole comes out to collect grass and leaves for the nest.

On most warm nights in summer and early autumn earthworms appear at the surface crawling about the grasses and pulling leaves into their burrows; earthworms, too, are mating. The mole takes great toll of worms at such times. Prolonged drought may also bring moles out in search of water. There are records of the ground being so hard that the moles on the surface found it very difficult to dig in again and were killed by dogs.

Food of the Mole.

The teeth, the short intestine, the rapid digestion, the dissection and examination of the contents of the alimentary canal, all proclaim the mole carnivorous. Earthworms form a chief food and seem the favourite diet, but the mole readily eats insect pupæ and larvæ of all kinds and slugs. Mice, frogs, lizards are also eaten. Ritzema Bos quotes a case where a mole placed in a cage ate in two days 432 cockchafer grubs and 250 worms. Another mole in twelve days accounted for 872 cockchafer grubs and 540 worms.

Adams' captive moles, when a supply of earthworms failed, took freshly killed voles and long-tailed mice when these were offered to them sliced up. The Rev. A. Woodruffe-Peacock reported to Adams cases of young blackbirds and young pheasants caught by the feet in shallow runs.

One of Miss Frances Pitt's captive moles refused bits of raw beef and rabbit's liver, while another was always ready for bits of mutton.

If two moles meet in a fight the loser is devoured by the victor.

Moles, then, have their preferences, but none of them are vegetarian.

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[1] Cadet de Vaux. Previously cited.

How miscellaneous the diet may be appears in the work of Mr E. E. Edwards, M.Sc.,[1] to whom I am indebted for the following information. Mr Edwards examined the contents of the alimentary canal of 52 moles sent to him for examination in the early part of 1939, and found 163 earthworms, 11 slugs, 6 spiders, 37 centipedes, 15 adult beetles, 79 wireworms, 214 leather-jackets (the larvæ of the daddy-longlegs), 53 cutworms or surface caterpillars (the larvæ of such moths as the Turnip Moth and the Heart and Dart Moth), and 314 other insect grubs.

Talpa europœa has an insatiable appetite. A mole may eat its own weight in a day. One of Miss Frances Pitt's captive moles was supplied with sixty earthworms a day, sometimes more. This mole weighed 3 ounces and the weight of worms was 4 ounces. Cordier in experiment, quoted by Ritzema Bos, placed a mole in a cage, and in four days the captive consumed 432 cockchafer larvæ and 250 earthworms. This seeming gluttony, however, is related to the mole's extraordinary activity and its amount of hard work. The 'stout navvy' requires a generous diet. Digestion is characteristically rapid, and the word indigestion seems absent from the mole's vocabulary. One recalls in connection with the mole's greed the constant feeding of active birds, while the sluggish snake may be satisfied with a once-a-week meal, or, according to the species, endure prolonged fasts.

The mole's feverish energy calls for hours of repose. Moles can be active at any time in the twenty-four hours, but there are more or less regular periods of rest and sleep. Some writers even venture the hours of the different night and day shifts.

The Voracity of the Mole.

"The mole's hunger is a sort of frenzy," wrote Saint-Hilaire. Some examples may be quoted of its voracity :—

"While walking[2] in the wood I heard the sound of sharp thin screams coming from the long grasses of the bank. Peering among them I saw a cruel sight, for writhing in vain efforts to escape was a half-grown frog, whilst gnawing and worrying at its legs and hinder parts I perceived a mole. Never before did I know a mole could be so active, for this one would let go, vanish among the tall grass stems, then glide up swiftly and recommence his savage attacks that caused the frog to cry out. Frightening him away with my stick I examined the frog; its hind-legs and stomach were chewed to a real pulp."

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[1] E. E. Edwards, M.Sc., Adviser in Agricultural Zoology, Advisory and Research Department of University College, Cardiff.

[2] 'A Farmer's Year.' By H. Rider Haggard.

Mr Edward R. Alston,[1] a naturalist and frequent contributor to 'The Zoologist,' kept a captive mole for nine days. He describes the mole as fierce and voracious. After giving his mole a feed of earthworms he offered the captive a large live frog. The mole seized the frog, which, by leaping, tried to get rid of the mole, but the mole held on. When the frog managed to get away it leaped round and round the mole, turning and turning, and the frog was caught again. Alston finding the scene unbearable, killed the frog, which was then devoured by the mole. In three days Alston's captive mole devoured "three or four dozen earthworms, a live frog, a quantity of raw beef, a turkey pout and part of another, and one or two black slugs." This mole, supplied with a vessel of water sunk in the ground, drank frequently. Miss Frances Pitt offered one of her captive moles a chicken's head with the feathers on.[2] This was attacked and worried so savagely that "I was able to raise the mole up by its tail in the air, hanging to the end of the neck." Further, a mole feeding on earthworms was oblivious to all else, and "could be held up by the tail while it went on eating."

How the Earthworms are Eaten.

In devouring earthworms the mole may begin to feed from either end of the worm. With smaller worms the start seems to be made indifferently. Even with large worms the mole may eat from the hind end forwards to the head, but in most cases the meal starts from the head end. Degerboel, who in his experiments had much opportunity of observing the behaviour of the mole in feeding on earthworms, describes what he saw. "The fore-paws so gripped that the claws of the two middle fingers met at the tips and the worm was drawn between them. The paws were not held still, but moved with small, short, sudden jerks whereby the external earth was removed from the worm. According to the size of the worm, the consuming of it took from five to twenty seconds. The process was slower if the consumption was from the hind end, and sometimes the mole would give up and carry on from the head end."

Do Moles Store?

Whether moles prepare stores of earthworms has been in doubt and debate for more than a century. There is repeated mention in the mole literature of Britain and the Continent of the reported finding of numbers of earthworms, in little clumps, in the Fortress of the mole and in the walls of the runs adjacent to it. Some reported the walls of the cavities and the runs, where the earthworms were found, to have been beaten so hard by the mole that the earthworms could not escape. On the other hand, some of the accounts recorded that the worms had been mutilated at the head end, so that they were unable to crawl away, although remaining alive and fit for food. It had to be admitted that collections of worms had been found, but doubters disputed the mole's part in the collection, suggesting instead that the collections of worms were more or less accidental collections of individuals that had strayed and collected in old disused mole-runs.

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[1] 'The Zoologist' for 1865.

[2] "Some Notes and Observations on the Mole in Captivity" in the 'Scottish Naturalist,' September and October 1917.

Even if the collections were stores, puzzling questions remained.

Why should the mole, which does not hibernate but remains active all through the winter, need to collect stores? If the collections were stores for the collector's own use in winter, how was it that at the end of the winter the stores were at their maximum instead of being depleted?

Perhaps they were for the young? But the female mole suckles her young. Further observation was called for. Gradually progress was made and light shed on the problem.

Adams for long remained sceptical as to storing, but ultimately changed his view. He had found no stores himself, but the farmer on whose land he was researching on moles, when digging out a Fortress on 30th March, found a mass of worms in the nest cavity close beside the nest. Adams[1] himself, feeding a captive mole one day, so fed it that the mole could eat no more. The surfeited mole then seized a worm, and after a few quick bites crammed it into the earth of its cage, left it, and turned to find another. A large lobworm was offered, and, treated by the mole like the first worm, was thrust into the same hole, and immediately covered up by earth scraped over it by its paws. On several other occasions a captive mole was seen to bury earthworms and once a dead mouse. The fullest proof of the storing habit, however, came from skilled workers and observers in Denmark, Holland, and Germany. I have followed up the literature, and the proof of the storing is interesting. In 1886, in Denmark, Dr Fried Dahl was asked to investigate the finding of a large number of worms in the Fortress of a mole shortly after a thaw, the soil under the Fortress being still frozen. Dahl found 1280 worms and 18 grubs of the cockchafer. The worms were stored up in the nest cavity and in the adjoining runs for a distance of nearly 5 feet. The worms, in groups of ten or so, were embedded in the walls.[2] These stores could not be winter stores, for they had been found at the end of a long strong frost. The explanation seemed to be that the period of frost was the time when the mole found the capture of earthworms easiest, with a consequent overplus of food. Dahl continued his investigations, and in collaboration with his friend, A. Schroter, published in 1891 the result of their new search. For easier reference I give the result in tabular form :—

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[1] Lionel E. Adams in 'Memoirs and Proceedings of the Manchester Literary and Philosophical Society.'

[2] 'Ueber Nahrungs vorrathe im Bau des Maulwurf. Schriften des Naturschaftlichen Vereins fur Schleswig-Holstein.' Bd. VI. 1886.

Explored.	Date.	Weather.	Result.
2 Fortresses	Dec. 1886	Before strong frost	No stores.
,,	Jan. 1887	After a slight frost	No stores.
,,	Mar. 1887	The whole winter, 1886-1887, mild and the soil not frozen	No stores.
,,	Nov. 1887		No stores.
,,	April 8, 1888	After a long continuous severe frost	One Fortress held 178 worms, 67 caterpillars of *Hepialus lupulinus*, the Swift Moth, 4 cockchafer grubs, 3 wireworms. The second Fortress held many worms.
,,	Dec. 23, 1888	After a slight light frost	No stores.
,,	Mar. 12, 1889	After a long continued frost	One Fortress had a store of 550 worms; the other many worms.
,,	Oct. 1889	At beginning of winter	No stores.
,,	Dec. 26, 1889	After a short light frost	No stores.
,,	Mar. 18, 1890	Winter an open one, with only 3 weeks' frost; no frost penetrated to any great depth	One Fortress with 8 worms and none in the other.

Careful examination of the stored worms revealed that the head end had been destroyed.

Evidence for storing accumulated. Professor Ritzema Bos of Holland, a leading European authority on Agricultural Zoology, received in 1898 from a teacher about 300 worms taken in a mole's Fortress, and found these in little heaps of seven or eight. Bos [1] examined these worms, and found them headless, the first three to six segments having been bitten off. A new skin had grown over the wound, but no regeneration [2] had taken place.

Untiring field-work and skilful observation had yielded this that the moles did store and that the stored earthworms were mutilated.

Experimental proof was forthcoming from the Danish worker Degerboel, who had been carrying on experiments for some time on the laying-up-of-stores problem. Degerboel [3] managed to keep a mole in captivity for six months. In experiment he gave the mole an overplus of worms. When the mole had eaten its fill of worms and seemed satisfied, the excess worms were offered. The mole became very restless, pushed the worms backwards and forwards, and in a strangely aimless manner hurried about among the worms and round the whole box in which it was captive. After bustling about among the worms for some time it became calmer and began a closer inspection of the box, frequently returning to the worms to make sure they were constantly there; then it selected a corner of the box, scraped the earth aside till the bottom boards were bare and ran back to the worms, seized one of them at one end with its fore-teeth, and quickly dragged it to the hole it had made. Here it pushed the writhing worm violently about in great excitement, and the worm, which was partly rolled up, was crammed into the hole. With tremendous zeal the mole now covered it up, using its snout, head, and all its forebody to throw earth upon it, and at last clapped the earth firm with its snout. In this way it buried ten earthworms one after another.

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[1] Ritzema Bos in 'Biologisches Centralblatt.' xviii. 1898.

[2] Regeneration = the repairing and replacement of lost parts.

[3] "Do Moles Store up Worms?" By Marcus Degerboel in 'Videnskabeilige Meddelelser fur Dansk Naturhistorisk.' Bind 84, Kobenhavn, 1927.

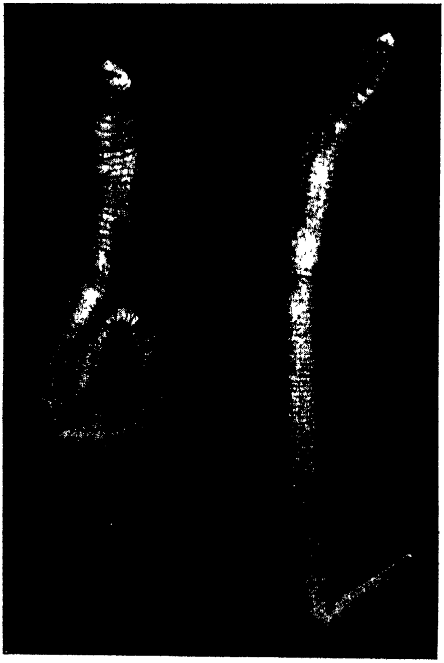

Fig. 14.—*Earthworms with foremost joints bitten off by a mole.* × 1½.
Degerboel's figure, with acknowledgment and thanks

Degerboel dug up the earthworms, and found that the foremost joints had been bitten off; otherwise the worms were unhurt, but unable to bore their way to possible safety.

The earth in the captive mole's cage had been rather shallow, and this had interfered with the burial of more than the ten worms. More earth was put into the cage, and into this deeper soil the mole at once burrowed and made runs. A rich supply of worms was offered on a tray. How the mole bustled! With astonishing rapidity it kept on rushing to and fro between the tray with the worms and its runs underground, each time dragging down a worm. The worms were generally pulled down into the ground. Several times when the mole came off the tray, close to one of the holes it had made, it would disappear into the soil head foremost 'almost in one jump.' The tray had held over forty earthworms; the mole removed them all and looked for more.

Degerboel in digging out the worms found them not in the runs but in the side-walls of the earth surrounding them. Of the forty-eight earthworms buried, fourteen had their heads mutilated; the other thirty-four were uninjured, though Degerboel's experience was that with smaller numbers every earthworm was mutilated.

Summing up the subject of storing we may say :—

1. That the mole may lay up stores is proved.
2. That the stores are laid up when there is a surplus supply of food. Instinctive storing when there is a surplus supply is familiar in other animals—*e.g.*, mammals, birds, and insects.
3. That the bulk of the store consists of earthworms, and these are most easily captured when there is a continuous hard frost, the worms being sluggish or torpid at such a time.
4. That the earthworms are decapitated, the first three to five segments being bitten away or at least mutilated.
5. We know that such worms are unable to bore, and they therefore lie trapped.
6. But earthworms have the power of regeneration or the replacement of lost parts, a faculty they share with some other animals. Thus a starfish can regrow a lost arm, a crab a lost leg—even the great claw; and some lizards can shed and replace their tail. An earthworm, cut in two, can grow a new head and a new tail, and some such wounded earthworms have been found with two tails. It is very likely that the inability of earthworms, whose head ends have been mutilated by the mole, to replace the front joints is due to their poor condition.

It is of great interest that the storing instinct of the mole is associated with another wonderful instinct, the mutilation of the worms, which yet remain alive and fit for food without the putrefaction that follows death. This recalls the wonderful case of the Solitary Wasps, where the female, having made a burrow, stores it, according to the species of solitary wasp, with caterpillars, or beetles, or crickets, or spiders, paralysing each one of the prey by a stinging thrust into one or more of their chief nerve ganglia. The mother wasp then lays an egg in the provisioned burrow, and when the wasp grub hatches it finds fresh unkilled food awaiting it.

BREEDING OF THE MOLE.

Dissection reveals a great development of the sexual apparatus in both males and females from the end of January onwards to the mating period. Mating typically takes place in March, by which time the boars have been looking for mates. The meetings are more or less chance ones. There is no proof that the males and females occupy at any time the same nest. In home and Continental literature the statement is frequent that male moles far outnumber the females, and that sanguinary battles in consequence take place between the males.

Lydekker[1] quotes a writer in 'The Field' who states the proportion of males to females as four to one. But we have no sure proof. In the beginning of last century Saint-Hilaire pointed out that the sex of unmated moles was very difficult to determine without dissection. Adams[2] verified this in numerous dissections, and as a result of his research stated that there is no disproportion of the sexes, and with this opinion Barrett-Hamilton[3] agreed.

As to the sanguinary battles between the males for the possession of the fair, though the mole may be incorrigibly quarrelsome and his 'only recreation a fight,' one calls for supporting proof.

There is only one litter in a year, with three to four young on an average to the litter, although the teats or mammæ—never very conspicuous even at the breeding season—are eight in number.

Evans'[4] examination of twenty-one pregnant females gave :—

Females.		Embryos.
1	contained	2
5	,,	3
11	,,	4
4	,,	5

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[1] 'Royal Natural History.'

[2] Lionel E. Adams in 'Memoirs and Proceedings of the Manchester Literary and Philosophical Society.' Vol. 47. 1902-1903.

[3] Gerald E. H. Barrett-Hamilton in 'The History of British Mammals.' Part VI., May 1911; and Part VII., June 1911.

[4] William Evans in 'The Mammals of the Edinburgh or Forth Area.' Supplementary Notes in 'Proceedings of the Royal Physical Society,' 1915.

Adams' figures for sixty-one females are :—

Females.		Young.
1	contained	1
4	,,	2
20	,,	3
31	,,	4
4	,,	5
1	,,	6

The maximum recorded is seven.

The period of gestation is four weeks and over. Young have been found in the second week of April and onwards into June.

The newly born young—2 inches long—are blind and hairless, and red to pink in colour. The colour gradually changes as the days pass. The fur shows in a fortnight, and in three weeks or just over, the velvety covering is normal. By this time the ears have opened and the eyes begin to show. In four to five weeks the young are ready to quit the nest. Adams states that full growth is not attained till the second year, and he believes the mole's length of life to be four to five years.

No Hibernation.

Moles do not hibernate. They are more or less active all through the winter. Throughout winter fresh mole-hills are thrown up, even in snow-covered ground, and with some degrees of frost. If the surface be frozen too hard for burrowing the mole goes deeper.

Economic Importance of the Mole.

Here we are concerned chiefly with the mole in its relation to Agriculture and Market Gardening. Even among farmers there is diversity of opinion as to the harmfulness or usefulness of the mole. Whether the mole is harmful may depend on local conditions and whether the farming is arable or pasture-land. In a word, the mole can be useful in one place and harmful in another.

Let us look more closely at what can be said for and against the mole.

As far as amenity goes it will be admitted that mole-hills are out of place on a lawn, or a bowling-green, or a cricket-pitch, or a polo-ground, or a garden. Phil Robinson humorously dubs the mole "a moral discipline for the landscape gardener." Where mole-hills are very numerous—and in some seasons on fertile soils they may be numerous enough to suggest, at some distance away, that the field has been ploughed—this may represent a considerable area of loss. The shepherd's eye—

> "With unforgiving enmity surveys
> The long concatenated sweep of hills
> Whose soft and crumbling soil abridges more
> The scanty pittance of his hungry fold."

Mole-hills interfere with mowing, clog the coulters, and damage the reapers.

The mole in its tunnelling loosens and breaks across the roots of plants.

Injury is done to all crops in the seedling stage. I have seen in a light soil whole rows of seedlings spoiled.

On the other hand, the mole's tunnels are useful in surface drainage, and the soil of the heaps makes an excellent top-dressing.

Of very considerable importance is the mole's destruction of large numbers of some of our most harmful insect pests —*e.g.*, wireworms, leather-jackets, surface caterpillars or cutworms, cockchafer larvæ.

The mole is sometimes harmful by its galleries undermining embankments. For example, in County Norfolk a stretch of meadow-land, of lower level than the tidal river, had to be protected against floods by an artificial embankment. Here moles proved very troublesome by their tunnels, weakening and undermining the embankment.[1] The mole-runs may be so numerous in canal or river banks that these give way on increased pressure from flood.

Those who praise the mole for its destruction of earthworms are paying it a very doubtful compliment. Though earthworms when in excessive numbers can be harmful to young seedlings, they are among the most useful animals in the world. They are makers of humus.

In boring into the earth the worm swallows the soil, which passes down the gullet to a muscular gizzard or crushing mill, and thence along a digestive and absorptive intestine. Deprived in its passage of certain food material on which the earthworm nourishes itself, the waste soil, now in a very fine state of division, is put to the outside at the mouth of the burrow in the form of the familiar castings of the worm.

Further, earthworms drag into their burrows leaves, partly for food and partly for shelter. The active work of the earthworms is done chiefly in the top 12 to 18 inches of the soil, and this is the region of greatest bacterial activity, where the decomposition bacteria, the nitrate makers, and other useful bacteria are at work.

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[1] Edward Newman in 'The Zoologist' for 1875.

The worm castings are a soil very favourable for seed-beds; the burrows serve for drainage and aeration.

For long the mole has been blamed by gamekeepers and others for the destruction of the eggs of partridges and pheasants, it being maintained that the mole of set design tunnels under a desired clutch of eggs. No one will dispute that a mole's tunnel may run under a nest of eggs, especially in certain more or less sheltered places, but the weight of evidence is in favour of such a happening being accidental and not intentional. One of the most observant gamekeepers I ever knew, interested in Natural History and with all the keeper's prejudice against vermin, never doubted that the presence of eggs in a mole's run was accidental. If a tunnel runs under a partridge's nest, the partridge in its scrape might pierce the roof of the tunnel, and in such a way the eggs might be 'let down,' and, of course, destroyed when the mole cleared the run.

There are those who call for complete extermination of the mole. Well, man is the lord of creation, but an animal has some right to live. Even though extermination was possible, the remedy might prove worse than the disease. Dr Wttewaall, described by Ritzema Bos as a thorough and skilled observer, tells how he had the management of a fair-sized area of cultivated land. Moles were common on the land. Repeated manuring with increased fertility brought more prey for the moles. The moles so multiplied that Wttewaall determined to try and get rid of them. He offered twopence for each caught mole, and in a few years had accomplished his purpose, save for a stray mole now and again from outlying fields. But the result of the mole destruction had not been foreseen. In a short time the number of injurious insects had so increased that the beet crop and other plants were ruined, entailing a considerable money loss.[1]

NATURAL ENEMIES OF THE MOLE.

The mole is not favoured as food by predatory animals. A dog or a cat will leave uneaten the mole which it has caught and killed. Weasels, however, eat moles, and they are sometimes caught in the runs in the mole-traps.

The Stoat is also an enemy. In 'The Field" for 8th November 1941, Mr Oswald K. Langley, Burnham-on-Sea, Somerset, had an interesting letter illustrated by a photograph of a mole-trap in which two stoats had been caught, head-in, on 12th September: one a male, the other a female. In kindly sending me the negative, Mr Langley told me that the stoats were three-quarters grown, and that nine moles had been caught in the same run the week before. Mr Langley also mentioned an old practice of the farmer to put a mole into a clogged field-drain pipe. "The mole cannot reverse, so burrows ahead and clears a passage through the pipe."[1]

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[1] 'Tiersche schädlinge und nützlinge.' By Dr Ritzema Bos.

Adams in experiment offered freshly-killed moles to the hedgehog. The hedgehog pulled the moles about in its endeavour to feed on them, but the mole's tough skin proved too much for the teeth of the hedgehog. But moles that had been used for dissection, or cut into pieces, were eaten up, only the skin being left.

Adams himself, thorough experimenter though he was, shied at eating adult moles, but recalling that baby moles were fed on milk, had some boiled, and, without salt or other seasoning, found them excellent: "much like a rabbit, the flesh being white and very tender."

Of birds, the Buzzard has been observed watching intently the movements of a mole tunnelling near the surface, ready to pounce did favourable opportunity offer.

The Brown or Tawny Owl is a proved enemy of moles that have ventured to the surface. Altum examined 210 pellets disgorged by this owl, and found in them the remains of 48 moles. This owl kills by a blow at the back of the mole's head. The Brown or Tawny Owl is the one that hoots—hoo-hoo-hoo—whereas the Barn Owl is recognisable by its shrill screech.

PARASITES.

The nests of our rodents and insectivores, as also the nests of birds, when shaken over a spread sheet of paper often yield a good catch of small predatory and parasitic insects and mites. This holds good of the mole and its nest. Of the nearly fifty different kinds of flea in Britain, at least four are found on the mole, and one or other of them may be in large numbers. Evans often observed baby moles spotted all over with flea-bites. The female of one of the mole fleas, named *Hystrichopsylla talpæ*, measures one-fifth of an inch.[2]

Kenneth Grahame in 'The Wind in the Willows' writes fancifully (good writing but bad Natural History) of the mole, but approaches reality when he says the mole "scratched and scraped and scrabbled."

Mites of the family *Gamasidæ* or *Parasitidæ* can also be found on the mole. Mites of this family have mouth-parts that can pierce and draw blood.

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[1] In a mole-run the animal can turn and proceed in the other direction.

[2] The flea of man (*Pulex irritans*) measures from one-eighth to one-sixth inch. The largest flea known, found in the United States in Oregon and Washington, measures up to one-third of an inch; it is parasitic on a rodent.

CONTROL.

On the Continent a method of protecting garden beds is to put in thorns, which warn the mole off by pricking and injuring its snout.

REPELLENTS.

Napthalene, Formalin, and Bisulphide of Carbon are stated to drive moles away because of their disagreeable odour, but more experimental detail as to methods of application and cost is desirable.

POISONING.

A number of substances—for example, arsenic and phosphorus—are directly poisonous to the mole, but even if the Poison Law allowed their use there would always be a risk to the life of useful animals.

Of poisonous substances, one may note Red Squill and Barium Carbonate.[1]

Some experiments with Red Squill against moles were undertaken by the Department of Agriculture and Horticulture of the University of Bristol under the auspices of the Ministry of Agriculture and Fisheries in 1928 and 1929.[2] In one set of experiments *Red Squill* as a powder was used and in another a liquid extract of Red Squill. The Powder Baits were prepared in this way. Red Squill Powder and fine flour were used in equal parts. After mixing these thoroughly earthworms were treated with the powder. The use of the flour was to make the Red Squill Powder adhere better to the worms. The mixture should be, roughly, one-fifth of the weight of the worms. In preparing, metal containers must not be used with Red Squill. In the experiments with Liquid Red Squill the baits used were shredded meat that had been soaked in the liquid for twenty-four hours.

The Red Squill Powder baits and the Red Squill liquid extract baits are placed in the runs of the mole.

The conclusion from both these experiments was that Red Squill baits "are satisfactory for ridding badly infested areas of moles."

Careful attention must be given to the following points :—

Red Squill baits need careful preparation.

They must be placed in the runs at once after preparation.

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[1] For an account of these, reference should be made to my article on "Rats and Mice" in the 'Transactions of the Highland and Agricultural Society for 1938,' and my article on "Voles and Shrews" in the 'Transactions of the Highland and Agricultural Society for 1939.'

[2] Journal of Ministry of Agriculture. July 1930.

The runs should be disturbed as little as possible. It was found in a similar experiment that where a run was very much disturbed, or where the naked hand had rubbed on the soil of the burrow, the mole escaped from the run just near to this point by means of a small run made to the surface.

Variation in the toxicity of Red Squill [1] can cause ambiguity.

Strychnine.—Strychnine is a colourless, odourless alkaloid obtained from the seeds of a tree (*Strychnos nux-vomica*), native in Siam, Burma, and Cochin-China. The seeds are known as *nux-vomica.*

Up to 1936 the farmer could buy strychnine, which was used for poisoning vermin. It was in great favour with the mole-catcher for killing moles.

Strychnine is a most dangerous poison to all kinds of animals; it acts primarily on the spinal cord.

By the Pharmacy and Poison Act the sale of strychnine was forbidden except as an ingredient in human medicine. In medicine it is used as a tonic and stimulant. Very little strychnine is needed to poison an animal, but the liquor sold for medical purposes is useless against the mole.

Urgency in food production has led to a modification of the Poison and Pharmacy Act, and an Amendment (August 1940) allows the use of strychnine for the poisoning of moles, but for this purpose only. The Amendment states:—

1. A person producing a written authority from the Executive Officer or the Secretary of a County War Agricultural Executive Committee, or, in Scotland, the Chairman or Secretary of an Agricultural Executive Committee, is authorised to purchase strychnine for the purpose of killing moles. The quantity bought must not be more than four ounces, specified in the authority.
2. A person to whom strychnine is sold for the purpose of killing moles *shall not use the strychnine for any other purpose, and shall take proper precautions for preventing access to the strychnine by other animals.*

There are slight variations in the way of preparing the strychnine bait that is to poison the mole—*e.g.*, the earthworm's head is cut off and a crystal or two of strychnine laid on, and then the bait is placed in the mole-run and the run closed; or worms with their heads cut off have a little strychnine rubbed on them with a match or small piece of stick, and then placed in the run; or worms may be rubbed in the strychnine and then dropped here and there in the run.

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[1] 'Transactions of the Highland and Agricultural Society for 1938,' previously cited.

Great care, of course, must be taken to keep strychnine out of reach of domesticated animals and of poultry.

GASSING OR FUMIGATION.

Against rodents gassing with hydrocyanic acid gas proved very successful, and it is also a humane method of killing. Some work has been done with this method directed against moles. The powder or dust, calcium cyanide, is blown into the runs by means of a hand or a foot pump. In the presence of moisture—the moisture of the soil or air—a very poisonous gas is given off. When all the gas has been liberated a solid deposit is left behind, which is harmless. To be poisoned the moles must be in the treated run. Different writers have described the mole as very regular in its hours of work and rest, and in the hydrocyanic gas fumigation it has been assumed that the mole tunnels and feeds three times a day—viz., at 8 A.M., 12 noon, and 4 P.M. We want more certain proof of this.

How to Fumigate.—Locate the main run. By means of a trowel open the run sufficiently to allow of the introduction of the nozzle of the duster and blow in the powder. Repeat at points where the gas is seen to emerge. Full equipment costs £10.[1]

The gas is not inflammable. It is very poisonous, and the operater should charge the container in the open air, should stand to windward in charging, and should be careful not to inhale the dust or the gas.

In the University of Bristol's experiments the moles were driven from the experimental area, but moles carried on their work in the surroundings.

STALKING WITH DOGS.

Every now and again one meets with or hears of a terrier skilled and interested in mole-catching. A dog 'with a nose,' if its trainer only exercise patience enough, can become very expert. Once the dog, working on its own, has secured its first mole the rest is easy, and improvement continues. Mr J. C. Bristow Noble some time ago gave an interesting account of his experience. Mr Bristow Noble's first mole-catching dog was a wire-haired terrier. Walking one day with the wind in their faces the terrier stopped suddenly at a small increasing mound of earth. At a word from its master "she struck instantly, thrusting her muzzle into the soil, and the mole was between her teeth." Once understanding that the mole was her quarry, the terrier would quarter the ground about fifty yards ahead of its master with stealth and caution. "It was not long," writes Mr Bristow-Noble, "before, wind and other conditions favourable, the terrier could scent a mole when still half a dozen inches in the ground. She would hold her head high and nose the air to make quite certain of the direction in which to move. Then the stalk began. Inch by inch, lifting each foot with care, she advanced until at length she was standing over the exact spot where the mole was busy foraging, and then she would wait probably ten minutes or longer for the great moment."

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[1] George Monro, Ltd., Waltham Cross, Herts.

In stalking, one walks with the wind in the face. Too loud breathing or the accidental cracking of a twig or a stubble will make the mole burrow deeply.

TRAPPING.

With the work done by an experienced and knowledgeable mole-catcher, trapping is the most satisfactory method of getting rid of moles. A number of different types of trap are on the market. The old-fashioned trap was a cylinder or a semi-cylinder of wood with horse-hair nooses at each end. The trigger was a peg, which on being touched by the mole brought the mechanism into play, the mole being held in the now tightly drawn noose. To-day wood may still form the body of the trap.

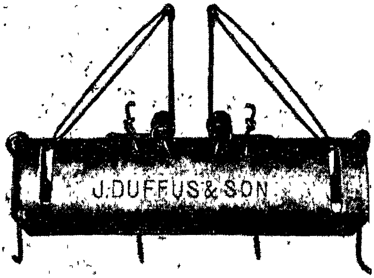

Fig. 15.—*Duffus Mole Trap.*

Experienced mole-catchers may make their own traps and have their own secrets. I had the pleasure of going round with Mr George Butler, Mole-catcher, Haddington, and I can bear witness to the efficiency in the field of his own-made traps of wood and steel. Mr Butler's family has been associated with mole-catching for several generations, younger members going through a regular apprenticeship of training in patience and skill.

Of the now more commonly used steel traps, there is a number of types. One of these, shown in Fig. 15, is the Duffus trap, a double-spring patent steel trap. The trap is in the form of a half-round trough of graduated steel six inches long and two and a half inches across. To this are attached hoops of steel, in which the mole is caught and held. Two slots, half an inch apart, allow a wire loop to pass through and down to the bottom of the mole-run, into which the trap is laid. Each wire loop is drawn hard up against a central piece between the two slots by means of a powerful spiral spring. In setting the trap the wire loops are pushed down and held by the wire over them hooked into a wire trigger. The mole is caught in passing through the spring loop, and caught with such force that it is at once killed by being forced against the top of the steel cylinder. It is advised that when the trap is empty the spring should not be let up with a bang, so as not to risk putting the throttle loops out of shape. This trap costs 2s. 6d.,[1] and has a very good record.

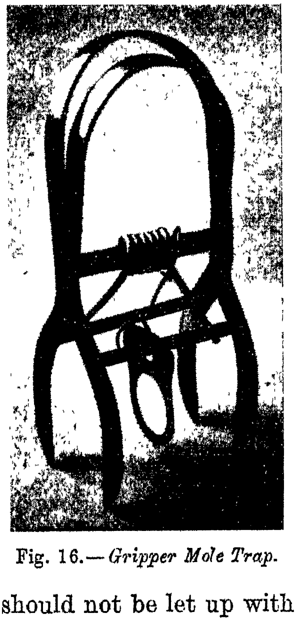

Fig. 16.—*Gripper Mole Trap.*

THE GRIPPER MOLE TRAP.

The claim is made for this trap, invented by Mr Van der Byl,[2] and approved by the R.S.P.C.A. and the S.S.P.C.A., that it is a sure prevention of the lingering death of the caught mole.

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[1] Spence & Gerrard, 21 Forth Street, Edinburgh.
[2] Wappenham, Towcester, Northants.

The points of the trap are :—

It is fitted with a powerful coil-spring, which grips the mole with an 8-lb. pressure over the heart, killing it at once without injuring the fur.

Straight-sided jaws, which allow every access to the mole.

Made of galvanised steel, and weighs only 8 ounces.

In setting the trap in the run take care that the holes on either side of the run-way are kept clear.

The trap costs 1s. 3d., plus 5d. postage.

In case of difficulty about the procuring of traps, information can be had from The Fur Trade Export Group, Vinter House, Queen Street Place, London, E.C. 4.

IMPORTANT POINTS IN TRAPPING.

The most favourable time is from December to the middle of March—*i.e.*, before the breeding season, and when the mole is in full winter coat.

The traps are laid in the main tunnels or runs, and great care should be taken to disturb the run as little as possible. Earth should be placed over the trap so as to ensure that no light penetrates to the run. It is not an easy matter for the beginner to find the runs and to know where actually to place the traps. Perseverance and keen observation are necessary, and a walk round and conversation with an experienced mole-catcher will be found very helpful. It may be stated that in neglected ground runs are made in moist land in the open, and in cultivated ground, more in the open in spring. Trapping may send the moles to more protected places—*e.g.*, the neighbourhood of hedgerows. A sudden flooding of meadows where moles have been working can mean a big catch on neighbouring ground above the reach of the flood.

Elsewhere in this article I have mentioned the mole's suspicious nature, and so in trapping certain precautions may be taken, such as burying a new trap before use in the soil to give it an earthy smell; and in setting the traps to have the hands rubbed in soil. The traps do not need to be baited, though Captain Mayne Reed, in one of his books, tells how successful his mole-catcher was in attracting moles by bottling up a number of earthworms till they passed into a jelly-like condition, and then dropping some of this into the run near where a trap had been set.

HOW TO SKIN A MOLE.

In a leaflet issued by the Fur Trade Export Group,[1] the following instructions are given :—

Always skin the day of trapping.

Make a clean cut from throat to tail down the centre of the belly.

Cut off feet and nose end of head. Work off the pelt gently.

Square to shape by hand stretchings.

Nail to a board, fur side down, with four tin tacks, one at each corner.

Leave to dry stiff in a warm room, but not near a fire.

Use no salt, alum, or chemicals.

The skin of a fully grown mole when nailed out should measure about 5 inches by 4 ; younger moles, about 4½ inches by 3½.

The treatment of the skins as just described seems very simple, but actually it is the result of much experiment on the part of Augustus C. Edwards & Sons of Alban House, Hereford, the pioneer introducers of moleskins, in 1902-03, to the British fur trade. Beginning modestly, the result in time was the marketing of attractive fur coats and other garments. Since the marketing of moleskins as a commercial article, the prices of skins have varied according to their quality, their abundance, and the vagaries of fashion. At present the best skins average sixpence to sevenpence.

I am indebted to A. C. Edwards, Esq., for the courtesy of the following note : "The highest price we ever paid trappers for moleskins was in the winter of 1920-21, when for a few weeks we paid 3s. each for No. 1 moleskins and 3s. 3d. each for 'Supers.' The 'Supers' were required for an order of 10,000 for America, and when auctioned in Montreal brought a dollar each."

I am indebted to Mr John M'Hardy, B.Sc., for the skilful copying of Figs. 10, 11, 12, 13, 14.

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[1] The Fur Trade Export Group. Vinter House, Queen Street Place, London, E.C. 4.

INSECT AND OTHER PESTS OF 1941.[1]

By A. E. CAMERON, M.A., D.Sc., F.R.S.E.,
Consulting Zoologist to the Society.

WHEN we talk of war we are apt to imagine that it has to do only with the struggle and contention that intermittently involve races, nations, or political parties in internecine strife. Explain the causes as we may, we are forced to the conclusion that the process is but an expression of that general conflict which goes on continually in nature among animals competing with each other for food and space or territory, lately familiarised to us as 'lebensraum.' Let us not forget that whilst the fortunes of war are determined by human courage and doggedness in all its theatres, vital issues are often decided by other factors which may at first appear to be insignificant, but increase in importance if neglected. During the Great War of 1914-1918 we heard much of war's 'minor horrors,' and not the least of these was the human louse, which brings in its wake, to military and civil populations alike, the dread diseases of typhus, relapsing and trench fevers. Since control of these diseases can only be satisfactorily accomplished by the control of the louse, special provision was made by the combatant armies for periodic disinfestation of soldiers' clothing. This required the establishment and administration of centres specially staffed and equipped to undertake the work of control, all of which meant the diversion of effort and resources from the main prosecution of the war.

But the louse is not the only minor horror that follows in the wake of war, nor is it one with which we are here concerned. There are others, less repulsive perhaps, but nevertheless important because of the deterioration for which they are responsible in stored products—a class of commodities in which are included raw and manufactured goods such as grain, milled cereals, cocoa, chocolate, dried fruits, shelled nuts, spices, and cured meats, also animal feeding-stuffs such as forage and oil-cake.

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[1] Because of the great importance of the subject at the present time, this year's entomological article is entirely devoted to a consideration of the more common insect and other pests affecting stored products.

Under normal conditions British farms can produce only 40 per cent of the nation's food, which means that the remaining 60 per cent has to be imported from abroad and stored by the shippers until such time as it is passed into circulation by agents, wholesalers, and retailers, each of whom may have to provide storage whilst the materials are processed or manufactured before their purchase by the ultimate consumer. The important factor about the manipulation of stored products is their storage, which may be of comparatively short duration in times of peace, but considerably prolonged in times of war. Stored products must then be accumulated in large quantities as opportunity offers, in order to provide for all contingencies and especially to offset the possibility of interrupted transport to our shores from producing countries overseas. By these circumstances there are provided for the pests of stored products two conditions which favour their increase—namely, bulk of breeding material and prolongation of the period of storage.

Thus it is that although insect and other pests of stored produce are, like the louse, always with us, they assume a much greater importance in war-time because of the opportunities presented to them for committing increased damage to the nation's life-line—its reserves of food; and so, like the louse again, they may be legitimately considered as another example of war's minor horrors and aftermaths.

MODE OF INFESTATION.

Pests of stored products are continually being carried from one country to another by commerce, with the result that the majority is now cosmopolitan, and the country of their origin cannot always be readily discovered. Their adaptation to the wide range of climatic conditions existing in the various countries of their adoption is more apparent than real, since their habitat in mills, stores, and warehouses remains more or less uniform wherever they may occur.

As a general rule, insects which attack growing crops in the field are not those which infest the produce of these crops in the store. Abroad, in warmer countries, there are, however, a few exceptions, and among them the Rice Weevil, the Angoumois Grain Moth, Potato Tuber Moth, and Pea and Bean Beetles are well-known examples. In Britain there are, so far as we know, no insect pests of stored grain which attack field crops, so that the latter cannot be said to be a source of infestation for stored grain and its products.

The methods, then, by which fresh stocks of stored produce become infested by insect pests are mainly direct, and depend on their close association with already infested sources, such as—

(1) Railway trucks or cargo vessels which have previously carried infested consignments of stored products and have not been disinfested after being unloaded.

(2) Mills, stores, and warehouses in which there are or were housed infested stores and the premises left untreated.

(3) Used sacks employed for packing bulk materials without having been disinfested.

Of all the hundred-odd insects that have been recorded in stores and mills, only a very few are primarily injurious to sound grain. The two most important of these are the Grain Weevil, *Calandra granaria* (Fig. 17), and the Rice Weevil, *C. oryzæ*, which burrow into the undamaged kernels of grain. To the dust which results from their gnawing activities there are attracted several secondary pests like Flour Beetles and Flour Moths, which in due course may become primary pests of the products manufactured from the infested grain. It is therefore important that milling firms should purchase nothing but non-infested grain, otherwise they stand to risk not only their own business reputations, but those of their shop-owner customers.

Popular beliefs die hard, and the theory concerning the spontaneous generation of insects is no exception. So far as insects and mites of stored products are concerned, there would appear to be in the minds of its supporters strong reason for its entertainment. "Do not infestations in stores and warehouses," they argue, "often appear from *nowhere*, and do they not spread with rapidity through large quantities of material?" The answer is in the affirmative; but what the observer may fail to appreciate is that from an initial small focus pests of stored products are capable of multiplying with amazing rapidity. The stimulus to increase is chiefly one of temperature, and where below 50° F. insect activity may be negligible and imperceptible to the casual observer, it becomes progressively accelerated with higher temperatures. Correspondingly, the numbers, too, increase until they compel attention. Needless to say, there is nothing in all these facts which would lead one to suppose that insects of stored products, chiefly beetles and moths, are different from other insects in their breeding habits. Mature females deposit their eggs in the material on which the larva feeds when it hatches. Here the latter grows and moults, finally changing to the non-feeding, resting chrysalis or pupa, which precedes the adult moth or beetle as the case may be.

In the appended table are included some of the more common insect and mite pests of stored products recently recorded in Scotland. The list is composed of 21 beetles, 3 moths, 1 psocid louse, 1 fly, and 2 mites. It is not exhaustive, neither as regards the number of kinds of pests nor the commodities which each may infest. The reader who may wish greater detail is referred to a very useful book by Hayhurst and Britten,[1] in which under each pest discussed there is a lengthy list of infested substances, and there is, moreover, a commendable appendix, in which under each commodity there is given a fairly complete list of infesting pests.

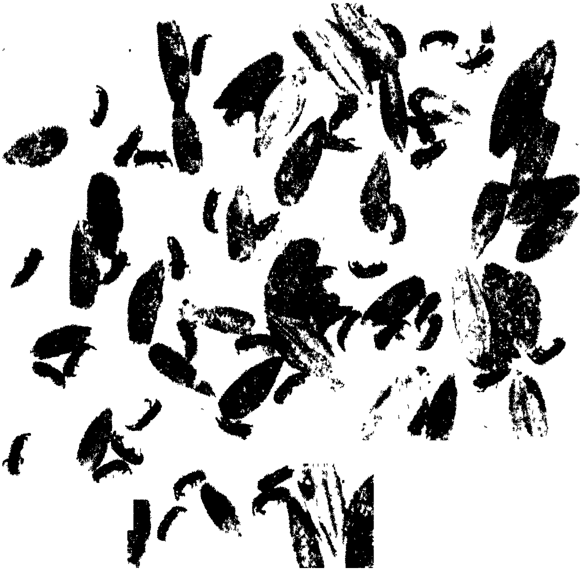

Fig. 17.—*The Grain Weevil,* Calandra granaria, *and grains of barley damaged by the weevil.* × 1.5.

From nature.

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[1] Hayhurst, H., and Britten, H., 1940. "Insect Pests in Stored Products." London.

SOME OF THE MORE COMMON INSECT PESTS OF STORED PRODUCTS RECENTLY RECORDED IN SCOTLAND.

Scientific Name.	Popular Name.	Stored Products infested.
Calandra granaria	Grain Weevil	Grain, rice, pearl barley, tea.[1]
C. oryzæ	Rice Weevil	Rice, grain.
Tribolium confusum	Confused Flour Beetle	Flour, rolled oats, sago, malt, tea.[1]
T. castaneum	Red Flour Beetle	Flour, rice meal, maize meal, rolled oats, biscuits.
Gnathocerus cornutus	Broad-horned Flour Beetle.	Flour, rice meal, dairy cake, sharps.
Tenebrio molitor	Yellow Mealworm	Flour, meal, ships' biscuits.
Alphitobius piceus	Black Fungus Beetle	Rice, bran, flour.
Tenebroides mauritanicus	Cadelle	Flour, rice, barley, oatmeal.
Oryzœphilus surinamensis	Saw-toothed Grain Beetle.	Flour, oats, barley meal, tea.[1]
Lœmophlœus minutus	Flat Grain Beetle	Maize, wheat, meal, flour.
L. ferrugineus	Rust-red Grain Beetle	
Stegobium paniceum	Drug-store Beetle	Seed, macaroni, cotton-cake, biscuits.
Ptinus tectus	Australian Flour Beetle.	Flour, ground rice, red pepper, wax-comb.
Niptus hololeucus	Golden Spider Beetle	Flour, oats, thirds, woollen goods.
Trogoderma granarium	Khapra Beetle	Indian barley.
Dermestes lardarius	Larder Beetle	Hides, bacon, dog-biscuits.
Carpophilus hemipterus	Dried Fruit Beetle	Dried apricots, figs, prunes.
Necrobia rufipes	Red-legged Ham Beetle.	Ham, dried figs.
Cryptophagus pilosus	Fungus Beetles	Grain, flour, tea.[1]
C. acutangulus		
Bruchus pisi	Pea Beetle	Dried peas.
Ephestia kuehniella	Mediterranean Flour Moth.	Flour, oatmeal, semolina, chocolate, chocolate biscuits, walnuts, raisins.
E. cautella	Fig Moth.	Currants, raisins, chocolate, dates.
Plodia interpunctella	Indian Meal Moth	Maize, wheat, chocolate, nuts, raisins.
Piophila casei	Cheese Skipper	Cheese.
Troctes divinatoria	Psocid Louse	Semolina, dried fruit.
Tyroglyphus farinæ	Forage Mite	Middlings, flour, feeding-stuffs.
Glycyphagus domesticus	Hay Mite	Hay, poultry food.

In the brief space at our disposal it will not be possible to do other than discuss very briefly some of the more important pests appearing in the foregoing table, and in this regard the reader is recommended to consult an illustrated pamphlet[1] recently published by the Department of Scientific and Industrial Research.

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[1] Tea is a commodity which is not troubled by insect pests in storage. It is, therefore, interesting to note, by reference to the table, that the Confused Flour Beetle (*Tribolium confusum*) and the Saw-toothed Grain Beetle (*Oryzœphilus surinamensis*), which are common pests of flour, were found in tea, a consignment of orange pekoe packed in plywood cases and imported from Africa. In the course of transit by ship the boxes had been damaged by a leakage of water into the hold where they had been stowed, with the result that they had absorbed moisture, swollen, and burst. The beetles which had been present in the hold had entered the damaged cases and become distributed throughout their contents. That their presence was purely fortuitous was demonstrated by a simple laboratory experiment. Specimens of the live beetles were confined with tea in petri dishes in an incubator, but they neither fed on the tea nor did they breed in it.

WEEVILS AND OTHER BEETLES.

Beetles compose the greater part of the insects which infest stored products, and they are doubly important, since they are injurious both in the adult and larval stages. So far as grain is concerned, weevils are second to none in point of destructiveness, and they are readily distinguished from other beetles by their long snouts and elbowed antennæ. They have, too, a trick of feigning death when disturbed.

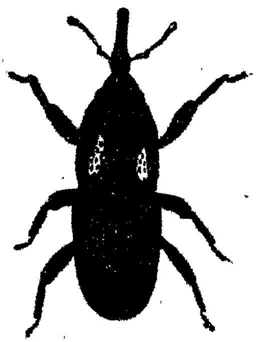

Fig. 18.—Calandra granaria.
Grain Weevil. ×10.
From nature.

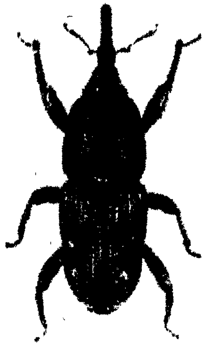

Fig. 19.—Calandra oryzæ.
Rice Weevil. ×10.
From nature.

GRAIN WEEVILS.

In Britain there are two kinds of grain weevils, of which *Calandra granaria* (Fig. 18), the Granary Weevil, is the more common. It may be identified by its dark-brown or blackish colour, the coarse oval pits on the anterior half of the body, and the absence of wings beneath the wing-covers. The adult female may live for as long as seven to eight weeks and lay about 200 eggs at the rate of one or two per day. In the smaller grains of wheat, barley, oats, and rye the female, by means of its snout, bores a hole, one per grain (Fig. 17), and after depositing a single egg seals the hole with a gelatinous substance. In the larger grains of maize the beetle makes several egg-borings in each. In ten days or thereby the egg hatches, and the resulting legless grub devours the contents of the grain for three or four weeks, ultimately leaving nothing but the outer husk. Inside this it pupates for a further week or so before changing to the adult beetle. In the course of a year there are three or four generations. With the onset of winter, breeding is slowed up and may actually cease, unless the grain should become heated as a result of heavy beetle infestation.

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[1] Anon, 1939. "Common Pests of Grain and other Stored Products." D.S.I.R., London. H.M.S.O.

The Rice Weevil, *C. oryzæ* (Fig. 19), often occurs in the same sample of grain with the Granary Weevil. If anything it is smaller, paler, and less shiny. The shallow pits of the fore-half of the body are smaller, round, and more numerous; on the hinder half of the body, above, there are four yellowish or reddish blotches. The Rice Weevil, unlike its relative, possesses wings, and by reason of its powers of flight it can pass from granary to granary. In warmer countries it breeds in grain in the field, whence it is transported to warehouse and granary, there to establish fresh infestations. In its habits and life-cycle the Rice Weevil resembles the Granary Weevil, only, the adult females are shorter lived, their span being one of four to five months.

THE CONFUSED FLOUR BEETLE (*Tribolium confusum*).

There are no insects which are more frequently found in granaries, mills, and warehouses than the Confused Flour Beetle (Fig. 20) and the Rust-red Flour Beetle (*T. castaneum*), which are recognised as the worst insect pests of flour and other farinaceous food. Although they are often introduced into mills with grain, yet they cannot feed on sound grain. Their presence in grain, therefore, is a sign that the latter has already suffered damage from Grain Weevils or some other cause.

The Confused Flour Beetle is identified by its shiny appearance, its reddish-brown colour, and the flat shape and parallel sides of its body. In size it measures about one-sixth of an inch long. Its antennæ are clubbed, but less markedly so than those of the Rust-red Flour Beetle, which it closely resembles.

The females continue to live for about a year, during which they lay 400 to 500 eggs at the rate of one or two per day, scattered throughout the flour. The surface of the egg is coated with a sticky secretion, which causes particles of flour to adhere to it, and this, together with its minute size, makes the egg a difficult object to discern. In a week or so the egg hatches, and a yellowish-white grub emerges, which feeds on the flour and grows to a length of one-quarter of an inch. There then follows the delicate white pupa which transforms to the beetle in due course. The whole life-cycle occupies about six weeks, but is prolonged by cold weather.

BROAD-HORNED FLOUR BEETLE (*Gnathocerus cornutus*).

The Broad-horned Flour Beetle (Fig. 21) is readily distinguished from the Confused and Rust-red Flour Beetle by the peculiar mandibles of the male, which are armed with a pair of prominent, broad, stout horns, and it is to this feature that the insect owes its name. Otherwise it bears a general resemblance to the Flour Beetles in colour, shape, and size, only it is slightly more robust. In mills it is found in a large variety of manufactured cereal products and feeding-stuffs, but it appears to prefer flour and meal. Like the Confused Flour Beetle, the female is long-lived and lays 100 to 200 eggs. Under favourable conditions the life-cycle takes about eight weeks for its completion.

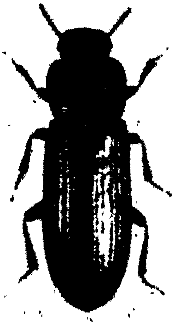

Fig. 20.—Tribolium confusum.
Confused Flour Beetle. × 9.

From nature.

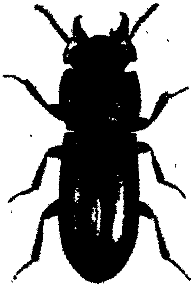

Fig. 21.—Gnathocerus cornutus.
Broad-horned Flour Beetle. × 6.

From nature.

THE YELLOW MEALWORM (*Tenebrio molitor*).

Among insects occurring in grain and cereal products the Mealworm (Fig. 22) is readily identified by its general resemblance to a Wireworm in colour, shape, and size. When full grown it is a honey-yellow colour, and measures about one and a quarter inches in length. It has become familiar not only because of its unwelcome occurrence in food-stuffs, but also because of its use as food for cage-birds. Along with the Yellow Mealworm there often occurs the Dark Mealworm (*T. obscurus*), which has the same habits. The adults of these insects are darkling beetles, a name which has reference to their nocturnal habits and their frequenting of dark places.

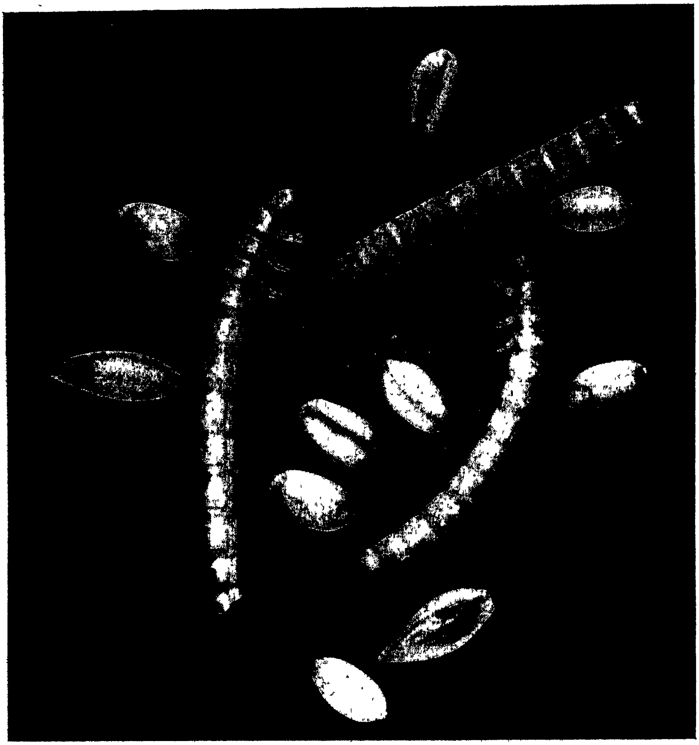

Fig. 22.—*The Yellow Mealworm,* Tenebrio molitor, *with grains of wheat to show relative size.* × 2.

From nature.

The development of the Mealworm is comparatively slow, and there is but one generation each year or every two years. The larvæ attain to full growth by the end of the summer, in which condition they hibernate. Pupation occurs in the spring usually at the surface of the food material, or in dark recesses to which the larvæ may have migrated. The adult beetles (Fig. 23), which are black and about half an inch long, emerge from the pupæ at the beginning of summer. They live for two or three months, and lay about 400 to 500 bean-shaped eggs. The beetle might be mistaken for the Cadelle (Fig. 25), but, unlike the latter, it lacks the median body constriction.

Mealworms are chiefly found in coarse cereals, and they are attracted to materials which are damp and slightly mouldy. Their removal from grain can be readily effected by screening and fanning ; in mills and warehouses they are best controlled by systematic and frequent cleaning, whereby waste cereals are not allowed to accumulate in odd places and provide breeding sites for the pest.

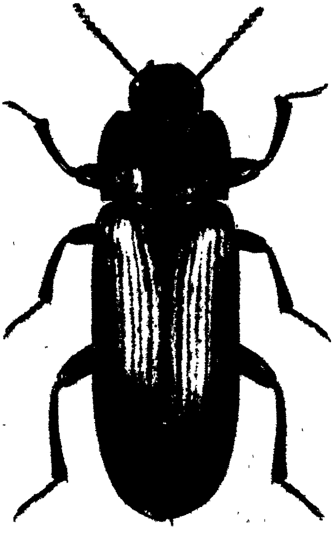

Fig. 23.—Tenebrio molitor. *The Yellow Mealworm.* × 4. From nature.

The Lesser Mealworm (*Alphitobius piceus*).

Like the true Mealworms, this insect (Fig. 24) is found in grain and cereal products that have deteriorated through damp or mould. It also occurs in neglected recesses under machinery, beneath grain and flour sacks. Grain that is sound and dry is not liable to attack by this insect.

Both the beetle and its larva resemble the corresponding stages of the true Mealworms. The former is smaller and proportionately broader, black or reddish-brown, and three-sixteenths to four-sixteenths of an inch in length. The larva is similar to the younger larvæ of the Mealworm.

THE CADELLE (*Tenebroides mauritanicus*).

The Cadelle enjoys the distinction of being the longest lived insect in stored produce, and individuals may remain alive for one or two years. It is found in mills, granaries, and warehouses, where it not only infests and damages flour, meal, and grain, but is destructive to bolting cloth used in milling, and to the woodwork of grain-bins into which the larva burrows. The damage which it does to whole grain is qualitative rather than quantitative, since it feeds only on the embryo of the kernel and rejects the remainder as being too hard to masticate.

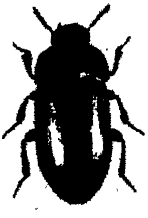

Fig. 24.—Alphitobius piceus.
The Lesser Mealworm. × 3·5.

From nature.

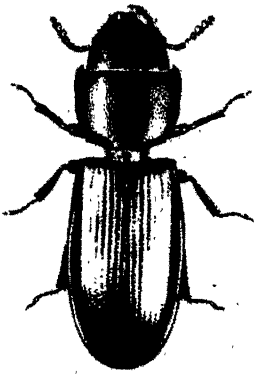

Fig. 25.—Tenebroides mauritanicus.
Cadelle. × 5.

From nature.

The beetle (Fig. 25) resembles that of Mealworms, but is smaller, being but one-third of an inch long and markedly constricted at the junction of the middle and hind parts of the body. Its general shape is oblong and flat, and its colour black or blackish.

The larva of the Cadelle (Fig. 26) is readily recognised by its dirty white fleshy body contrasting with the dark head, dark-spotted thorax, and two brown terminal spines. In its wooden burrows it can remain alive for months, emerging to infest fresh grain placed in bins. Paper and cardboard containers used for packing cereals may be bored by the Cadelle, which thus renders the contents susceptible to attack by an assortment of sundry other insect pests. The damage done by the Cadelle is by no means insignificant, but it would be even greater were it not for the fact that it has but one generation per year, and so it lends itself to control by regular and frequent cleaning of infested storehouses. Again, it should be remembered that the shorter the time susceptible stocks are kept in storage, the less their liability to infestation by this and similar pests.

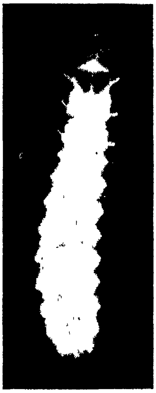

Fig. 26.—*Larva of the Cadelle.*
Tenebroides mauritanicus. × 2.
From nature.

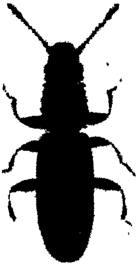

Fig. 27.—Oryzæphilus surinamensis,
Saw-toothed Grain Beetle. × 10.
From nature.

SAW-TOOTHED GRAIN BEETLE (*Oryzœphilus surinamensis*).

The scientific name of this insect (Fig. 27) was given by Linnæus in 1767 to specimens which he received from Surinam, and its popular name has reference to the six projections arranged like the teeth of a saw on either side of the thorax. Actually, the popular name is misleading to the extent that it is not a true grain beetle, but one which rather affects prepared cereals like meal, breakfast foods, flour, and even non-cereal products like dried fruits and chocolate.

The beetle is minute, about one-tenth of an inch long, slender, flat, and dark brown in colour. The female has a longevity of about ten months, during which it lays up to about 250 eggs. The larva, which is about one-fifth of an inch long, creeps about actively in the food material, feeding as it goes, and here, too, it pupates. The complete life-cycle takes four to ten weeks.

Cleaning infested quarters is not in itself sufficient to get rid of the Saw-toothed Grain Beetle, since, by virtue of its small size, it can creep into small cracks and crevices and escape dislodgment.

There are two other beetles belonging to the same family (Cucujidæ) as the Saw-toothed Grain Beetle which are common inmates of granaries: the Rust-red Grain Beetles (*Læmophlœus minutus*), one-sixteenth of an inch long, and *L. ferrugineus* (Fig. 28), one-twelfth of an inch. For their size they are elongate and narrow with fairly long antennæ. They are not primary pests of stored grain, but are associated with wheat, maize, flour, and meal that are out of condition. It is suggested that their larvæ are predatory on the larvæ of other grain pests.

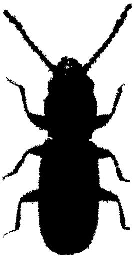

Fig. 28.—Læmophlœus ferrugineus.
Rust-red Grain Beetle. × 12.
From nature.

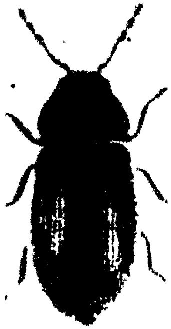

Fig. 29.—Stegobium paniceum.
Drug-store Grain Beetle. × 10.
From nature.

DRUG-STORE BEETLE (*Stegobium paniceum*).

There is perhaps no insect pest of stored products that is more catholic in its feeding than the Drug-store Beetle (Fig. 29), and it is thus all the more difficult to control. It has come by its popular name from the frequency with which it is met among drugs in chemists' shops and warehouses. The list of goods from which it has been recorded is close to a hundred, and some of these may be not even organic in nature, as, for example, cream of tartar, in which I once found a heavy infestation. The saying that it will eat anything except cast-iron emphasises the range of its diet. Among cereals it is at home both in whole grain and in grain products, such as macaroni; it is the 'weevil' of ships' biscuits, and it breeds prolificly in cattle-cake.

The adult is about one-tenth of an inch long, reddish brown, and covered with a coat of short silky hair. The grub is white and slightly curved. The complete life-cycle requires about two months.

AUSTRALIAN FLOUR BEETLE (*Ptinus tectus*).

This beetle is considered to be a native of the Antipodes, and was probably introduced into Britain about the beginning of the present century. It is a small, dull-brown insect (Fig 30), about one-eighth of an inch long. As is the case with other ptinid beetles, the thorax overlaps the head like a hood and is distinctly narrower than the hind-body, the under-surface of which is coated with fine golden hairs.

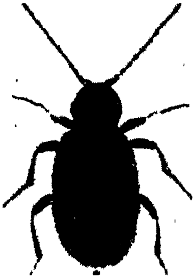

Fig. 30.—Ptinus tectus. *Australian Flour Beetle.* × 8.

From nature.

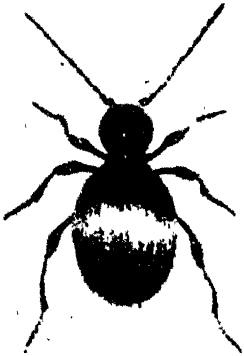

Fig. 31.—Niptus hololeucus. *Golden Spider Beetle.* × 6.

From nature.

The female lays its eggs in the food in summer, and the larvæ, which hatch in five to seven days, become full grown in the autumn. They are fleshy, crescent-shaped and white, feed actively and continuously, producing an abundance of frass, and by spinning a web they mat the food and render it useless. Previous to their transformation to pupæ the larvæ leave the food-material in search of suitable places in which to pupate; and in so doing they may bore through bags and cardboard boxes and spin their loosely woven cocoons in crevices, walls, and floors, and may even burrow into the walls of wooden bins. Thence the beetles issue later to infest fresh stocks.

Among a large range of food-stuffs, the following are representative: flour, biscuits, chocolate powder, cacao, nutmegs, almonds, ginger, dried fruits, cattle-feeding cake, &c.

A curious instance of the destructiveness of *P. tectus* was recently brought to my notice when it was discovered breeding in the comb of nests of the Humble Bee preserved in a museum case. Escaped specimens of the beetle had found their way to the nests from samples of infested oil-cake kept for observation in an adjacent laboratory. In the space of two years the nests had been reduced to a mass of frass and webbing, in which beetles, eggs, larvæ, and pupæ were indiscriminately mixed.

THE GOLDEN SPIDER BEETLE (*Niptus hololeucus*).

The Golden Spider Beetle (Fig. 31) is about one-eighth of an inch long, with antennæ almost as long as the body, which is thickly covered with golden hairs and scales. With its spherical thorax hiding the head, rounded abdomen and long legs, it is not unlike a spider. The wing-covers are fused down the middle and flight-wings are absent; thus it can only spread from house to house by crawling or by carriage in infested goods.

The life-history of the Golden Spider Beetle is said to take about six or seven months, and there are two generations per year. Its economic status is not very clear. Some authorities, such as Hayhurst and Britten (*loc. cit.*, p. 111), consider that it is an important pest of omnivorous habits, and it is recorded from a wide range of cereal products. According to my experience the beetle is not an uncommon inhabitant of dwelling-houses, shops, stores, and warehouses; but on one occasion only was it found to be responsible for some slight damage to woollen goods stored away in a drawer in a shop. On another occasion it was found infesting straw mattresses in a house, but here again food-stuffs were not affected.

THE KHAPRA BEETLE (*Trogoderma granarium*).

The Khapra Beetle is a native of India and introduced into Britain with barley. The beetle is brown in colour and oval in shape. It is about one-sixteenth of an inch long, with head small and eyes black and appearance velvety. The equable conditions provided by barley bins in breweries are favourable to the beetle, and it has become an important pest of the brewing industry and one difficult to control.

Under favourable conditions of humidity and temperature the life-history takes about fifty days, but may be greatly prolonged by the larval habit of retiring into any available cracks and crevices and assuming dormancy under unfavourable conditions.

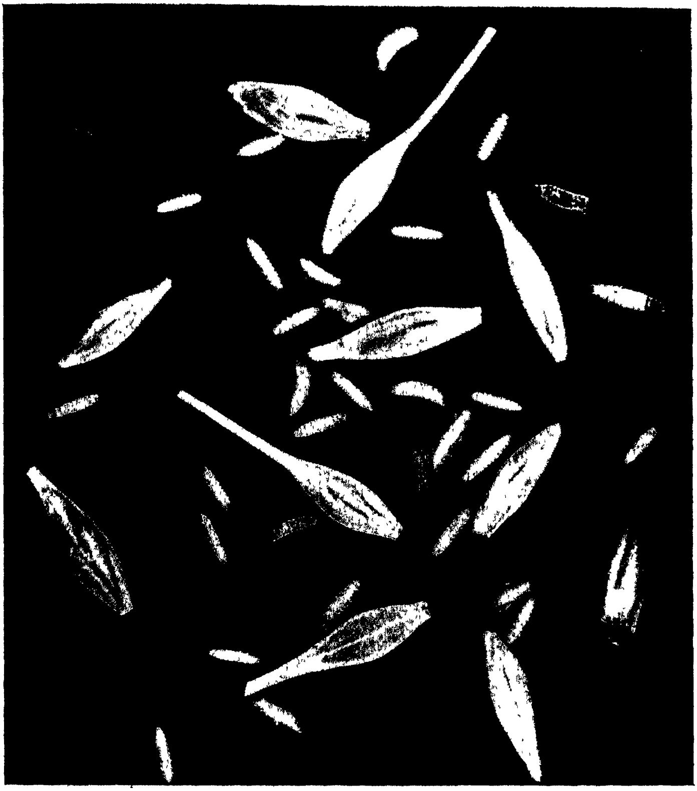

Fig. 32.—*Larvæ of Khapra Beetle,* Trogoderma granarium, *with grains of barley.* × 2.

From nature.

The adult beetle does not feed, and injury to the grain is entirely attributable to the yellowish larvæ (Fig. 32), which feed on the surface of, and do not bore into, the grain. First, the pericarp is destroyed.

Infested bins, after being made airtight, are fumigated with calcium cyanide at the rate of 2 lb. per 1000 cubic feet of space and left closed for a week.

THE LARDER BEETLE (*Dermestes lardarius*).

The Larder Beetle (Fig. 33) belongs to a family known as the Dermestidæ or skin-eating beetles, because of their fondness for the pelts and hides of animals. For food they prefer substances that have a high content of fat or protein. Their occurrence in cereals as well as in cotton and woollen fabrics appears to be purely accidental and not associated with damage. They must, therefore, be considered as migrants from some adjacent source of infestation, such as hides or bacon.

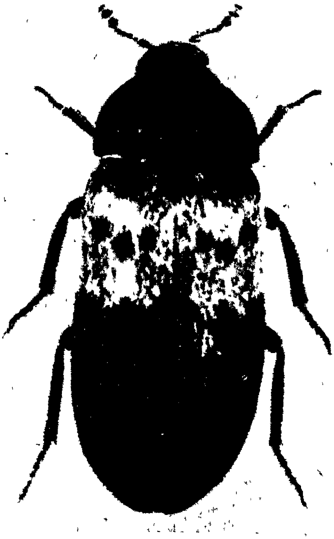

Fig. 33.—Dermestes lardarius. *Larder Beetle.* × 8.
From nature.

The Larder Beetle, which is cosmopolitan, is one of the larger and more conspicuous members of its family. It is about one-third of an inch long, dark brown, with a prominent greyish or pale yellowish-brown band across the back. The brown larva is half an inch long and coated with moderately long brown hairs, some of which form a wisp-like tail.

Both the beetle and its grub feed on animal products, such as ham, bacon, cheese, and butter. The larvæ bore into hams and cured meats which are protected by storage in meat-safes and by tight wrappings of cotton cloth. On no account should hams and similar foods be stored in cool dark cellars, where they are very liable to infestation. Larders are disinfected by spraying shelves and walls with an oil-pyrethrum insecticide.

DRIED FRUIT BEETLE (*Carpophilus hemipterus*).

The size, shape, colour, and habits of the Dried Fruit Beetle (Fig. 34) all serve to distinguish it. Although minute in size, being no more than one-tenth of an inch long, it is nevertheless of robust build, and its breadth is slightly less than half its length. Its general colour is black, but the short wing-covers, which do not extend to the hind end of the body, are relieved by two patches of yellow in front and two similar but larger patches behind.

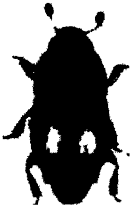

Fig. 34.—Carpophilus hemipterus. *Dried Fruit Beetle.* × 9.

From nature.

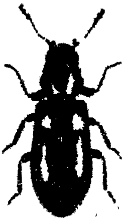

Fig. 35.—Necrobia rufipes. *Red-legged Ham Beetle.* × 7·5.

From nature

The larva is creamy-white in colour and about one-quarter of an inch long. It feeds on nuts as well as on fruit. At various times I have found the beetle among dried apricots, figs, and prunes. Infested boxes are made unsightly by excreta and moulted skins, which contaminate the contents and render them unfit for human consumption. To safeguard against such contamination, the fruit should be sterilised by submitting it to a temperature of about 180° F. before packing it in insect-proof cartons.

RED-LEGGED HAM BEETLE (*Necrobia rufipes*).

This beetle (Fig. 35) is about one-fifth of an inch long, metallic blue or violet in colour, and with legs reddish. The surface of the body is sparsely covered with dark hairs.

The female beetle lays its eggs in small clusters in recesses of cured meat, and they may hatch in four or five days. The larva is recognised by its dark-brown head, which is more slender than the dark-mauve, hairy body, and a pair of terminal, dark, upturned hooks. The larval burrows are usually confined to the fatty parts of the food material, such as ham, bacon, and smoked pork, and are fouled by the trail of waste particles which the larva leaves behind. Ultimately the larva attains a length of about half an inch, and is then ready to pupate. First of all, however, it goes in search of a suitable crevice, and makes therein a rough cocoon of a white secreted material, in which it transforms to a pupa. After two weeks the beetles appear. The whole life-cycle takes six weeks or more, according to the temperature.

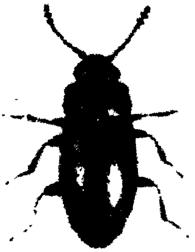

Fig. 36.—Cryptophagus pilosus.
A Fungus Beetle. × 12.

From nature.

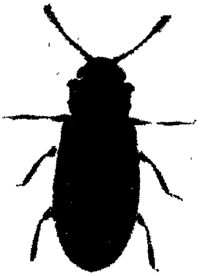

Fig. 37.—Cryptophagus acutangulus.
A Fungus Beetle. × 12.

From nature.

Cured meats are best protected against attack by wrapping them securely in stout canvas, which will resist penetration by the beetle.

THE FUNGUS BEETLE (*Cryptophagus pilosus*).

The economic status of this beetle (Fig. 36) is slight. I have found it and *C. acutangulus* (Fig. 37) fairly frequently in new houses, especially those which have become occupied before the plaster walls have had a chance to dry. It is usually associated with damp conditions, and stored produce from which it has been recovered is usually found to be undergoing deterioration. There is a strong suspicion that it feeds on moulds, which is further strengthened by the frequency with which it occurs in decaying vegetable matter.

The beetle, which is of non-obtrusive habits, measures not more than one-tenth of an inch in length and is brown in colour. I have found it in flour and also in tea that had been damaged by water. Like the Confused Flour Beetle and the Saw-toothed Grain Beetle, which were also present, it appeared to be a purely adventitious visitant in the tea, although moulds growing on the tea may have had something to do with its presence. It is not an uncommon beetle in bakeries, granaries, and warehouses.

Both *C. pilosus* and *C. acutangulus* have a tooth-like projection on either anterior angle of the thorax, but those of *C. acutangulus* are larger, more prominent, and reflexed.

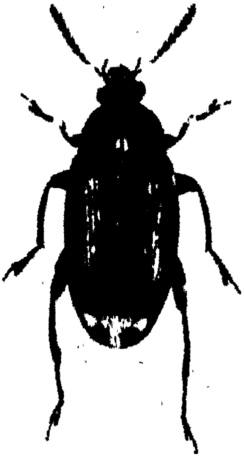

Fig. 38.—Bruchus pisi. *Pea Beetle.* × 8.
From nature.

PEA AND BEAN BEETLES (*Bruchus pisi*, &c.).

Dried peas and beans imported into Britain from warmer countries are frequently found to be infested by Pea and Bean Beetles, of which there are four common kinds—namely, the Pea Beetle (*Bruchus pisi*), the European Bean Beetle (*B. rufimanus*), the American Bean Beetle (*B. obtectus*), and the Spanish Bean Beetle (*Bruchus affinis*). With the possible exception of the Broad Bean Beetle, it is doubtful whether any of the four occurring in Britain are natives of the country, and would persist if they were not being continually reintroduced from abroad.

The Pea Beetle (Fig. 38) is of a flat shape and black colour. It is covered by a coat of minute brown hairs varied with patches of white. The wing-covers terminate a short distance from the hind end of the body, leaving the silvery end-piece, bearing two black marks, prominently exposed. In the countries of its origin the female Pea Beetle lays its eggs on the young seed-vessel or pod within the flower, and after a period of about two weeks a small grub emerges from the egg and bores into a seed inside the pod, there being usually only one grub per seed. The grub makes a cavity in the contents of the seed, and its presence is identified by a pale round spot on the wall of the pea, where the cavity is separated from the outside by a thin retaining membrane, later ruptured by the adult beetle (Fig. 39). Pupation occurs in the excavated seeds in autumn. The pupal stage is short and the pupæ are

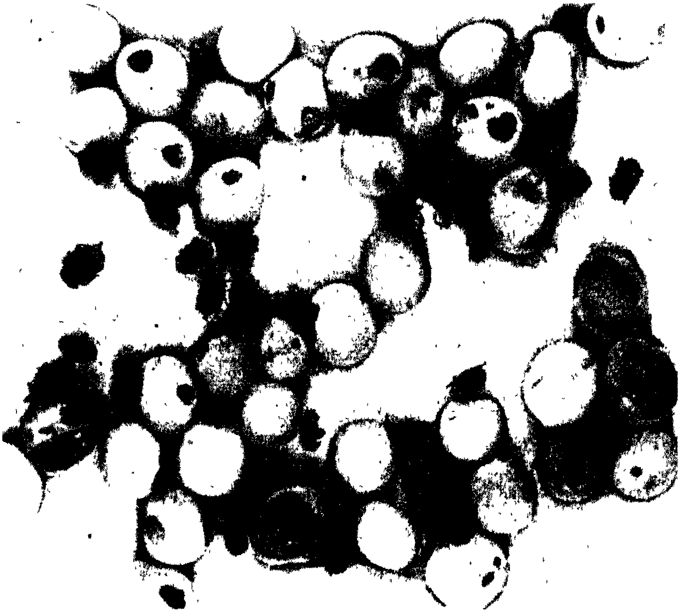

Fig. 39.—*Peas damaged by the Pea Beetle,* Bruchus pisi. *The holes are made by the beetles when they emerge from the peas.* × 1·5.

From nature.

soon succeeded by the adult beetles, which remain dormant in the dried seeds during the winter and emerge in the spring.

Despite the damage done by the beetles, a percentage of infested seeds contrives to germinate, those at least in which the embryo plant escapes injury. Provided the beetle is one which does not migrate from the warehouse to the field and attack growing crops, it seems hardly worth while to undertake measures of control against insects which do not breed in the dried stored seed. Actually both adults and larvæ are readily destroyed in the dried seed by fumigation with carbon bisulphide or carbon tetrachloride. Unlike the former, carbon tetrachloride is non-inflammable.

MEDITERRANEAN FLOUR MOTH (*Ephestia kuehniella*).

Moths are no less destructive to stored products than are beetles, but whereas both the larvæ and adults of beetles are injurious, moths are so only in the caterpillar stage. Depreciation of food-stuffs caused by caterpillar infestation is the result of contamination with excreta, and this damage may be further aggravated by the felting of the food material by silk fibres spun by the caterpillars wherever they go.

The Mediterranean Flour Moth is one of a small series of moths which prefer manufactured cereal products like flour, breakfast foods, and meal to whole grain, unless this has been damaged by some other pest or mechanical agency. The moth (Fig. 40), which has a wing-spread of about an inch, has fore-wings which are leaden grey with wavy black lines, whilst the hind-wings are a dirty white.

The small white eggs are laid in the flour, and will hatch in two to three days at 80° F. The caterpillars (Fig. 41), which are white tinged with pink, are hidden in silken tubes spun in the flour. After forty days the caterpillar is full grown, and is then about half an inch long. It then leaves the flour and meanders here and there in search of a suitable place in which to spin its cocoon. During this crawling stage of its existence the caterpillar mats the flour with its silk web. During warm weather the Mediterranean Flour Moth takes about nine weeks to pass through its egg, larval, and pupal stages.

Space will only permit of mention of two important relations of the Mediterranean Flour Moth—namely, the Cocoa or Chocolate Moth (*E. elutella*) and the Fig Moth (*E. cautella*). The former infests tobacco as well as cocoa and chocolate, and it is a common pest of cereals, dried fruits, and nuts; the latter is chiefly a pest of dried fruits and nuts.

Indian Meal Moth (*Plodia interpunctella*).

The materials upon which the Indian Meal Moth draws for feeding and the rearing of its brood include all kinds of cereals, flour, dried fruits, and nuts.

The moth is readily distinguished from other moths of stored produce by the presence of a conspicuous greyish-white band, which occupies the basal third of the otherwise reddish-brown fore-wings. The hind-wings are whitish-grey. With wings expanded the moth measures about three-quarters of an inch from tip to tip.

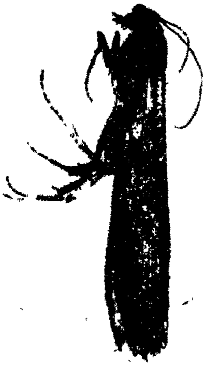

Fig. 40.—Ephestia kuehniella. *Mediterranean Flour Moth.* × 4.

From nature.

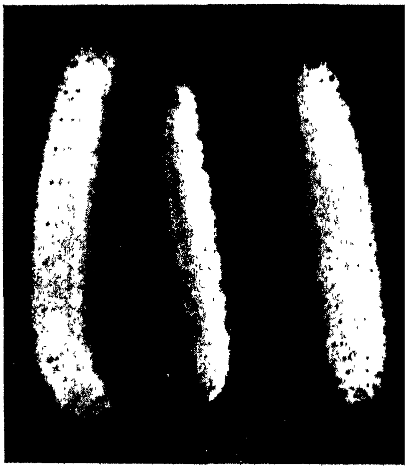

Fig. 41.—*Caterpillars of the Mediterranean Flour Moth,* Ephestia kuehniella. × 4.

From nature.

The female moth lays from 300 to 400 eggs in or near the material which serves the larvæ as food, and they hatch in four or five days. The full-grown larva is about half an inch long, dirty white in colour, and with sparsely distributed hairs. It bears a close resemblance to the caterpillar of the Mediterranean Flour Moth, only, the cuticular hairs on the latter arise from minute basal papillæ that are absent in the caterpillar of the Indian Meal Moth. At the end of its period of growth the caterpillar spins a cocoon in which it changes to a light-brown chrysalis. In warm weather the life-cycle may be completed in about a month to two months.

The Indian Meal Moth is a less serious pest in flour-mills than the Mediterranean Flour Moth.

The Cheese Skipper Fly (*Piophila casei*).

This insect is a small, shining black fly (Fig. 42), which measures about one-eighth of an inch long, and deposits its eggs not only in cheese, but also in ham and bacon. Its popular name has arisen from the trick of the maggot in leaping when it is disturbed. To accomplish this it bends its body in a state of tension until the two halves are almost touching, and the mouth-hooks catch on to the hind end of the body. Their sudden release and consequent relaxation of the tension provides a force that projects the maggot upward or in other directions for a distance of four or five inches.

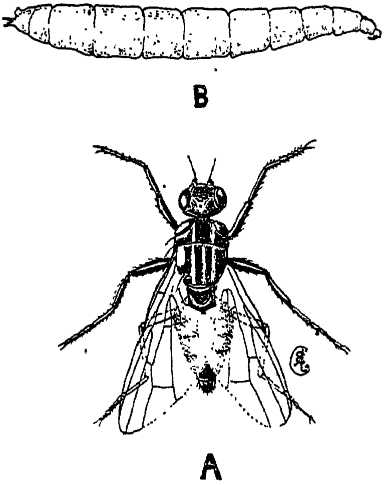

Fig. 42.—Piophila casei. *Cheese Skipper*.
A. *Fly*. × 3. B. *Maggot*. × 3.
From nature.

The maggots burrow in cheese or other food, rendering it unfit for human consumption.

The life-cycle takes about two to three weeks to complete, so that infested store-rooms become increasingly infested as time passes.

To bar the entrance of the flies, the doors and windows of stores should be fitted with a 30-mesh wire screening. Stores already infested should be either fumigated or treated with a spray of pyrethrum combined with kerosene or one containing derris.

BOOK LICE (*Psocida*).

The insects which are known as Book Lice or Psocids are no larger than a pin-head and soft-bodied. Normally they are associated with old books and papers, and they subsist on the paste of bookbindings and the moulds which grow on paper. Consequently they are usually found where conditions are damp and musty, and so they may occur in flour, meal, and grain as well as forage material undergoing deterioration as a result of increased humidity. In human food-stuffs their importance arises not so much from the actual damage they commit as from the nuisance which their presence and activities create.

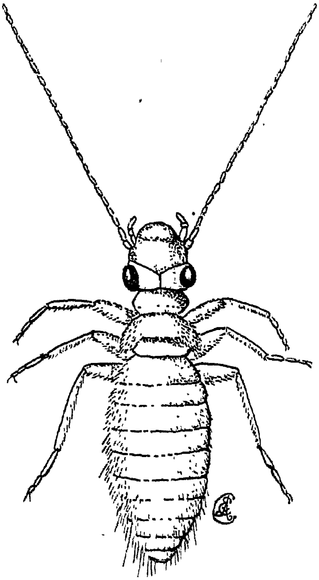

Fig. 43.—Clothilla pulsatoria. *Book Louse.* × 20.
From nature.

The Psocids which are most commonly found in cereals are *Clothilla pulsatoria* (Fig. 43), *Lepinotus inquilinus*, and *Troctes divinatoria*. Of these, the first is white in colour and the femora of the hind-legs are not expanded; the colour of the other two is brown, and the hind femora are swollen. The power of sound production has frequently been assigned to Psocid lice, but, so far as evidence goes, it would appear to be confined to the first two species mentioned above. The process consists in tapping the surface on which they rest by a tiny knob which projects on the under-side near the end of the body.

FLOUR AND GRAIN MITES (*Tyroglyphidæ*).

Tyroglyphid mites are pale greyish-white, soft-bodied creatures of microscopic size, and bearing many long hairs on their legs and backs. Some of them occur in grain and cereal products like flour and meal, and also in forage material. The most common of all such mites is *Tyroglyphus farinæ* (Fig. 44), the Forage Mite, of which the female measures about half a millimetre in length and a quarter of a millimetre in breadth. The body is divided into fore and hind parts by an encircling furrow behind the second pair of legs.

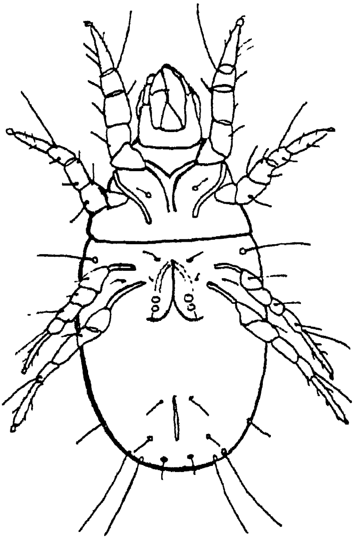

Fig. 44.—Tyroglyphus farinæ. *Flour and Grain Mite.* × 100.
From nature.

Often the first indication of a heavy mite infestation is the accumulation of a brownish dust on the floor at the margin of a pile of grain, flour, or forage, whether stored loose or in sacks. Examination of the dust shows it to consist of a mixture of grain, flour, or forage débris, mites of all stages of growth, including eggs, moulted skins, and fæcal material.

At temperatures of 60° to 75° F. and percentage moisture of 12 to 14, Newstead and Duvall[1] demonstrated that mites increase rapidly, and the infested material acquires an unpleasant mitey odour, which signifies deterioration in quality.

In grain the mites damage the kernels by penetrating the epicarp and destroying the embryo before attacking the endosperm. Finally, nothing may be left but the husk, containing a cluster of mites. Damage does not stop here. The spaces between the grains become filled with dust, fæcal material, and cast skins, which interfere with the proper ventilation of the mass and induce heating and mould development. In flour, mite infestation is much more serious than in grain, since the resulting contamination renders it unfit for human consumption. Not only is the smell of the infested flour objectionable, but the excrement of the mites causes a discoloration, which makes it unsaleable.

As the result of the researches of Newstead and Duvall, above quoted, it has been determined that mite attack can be prevented if the moisture content of wheat or flour in store be kept below 11 per cent. Mite-infested grain before being stored should be screened to remove the mites as much as possible and then warmed by a current of hot air to reduce the moisture content below the threshold which makes it liable to infestation.

Screening and fanning the grain usually reduce mite infestations effectively and remove all risk of injury to the grain.

CONTROL MEASURES.

The difficulties that are encountered in the abatement of insect and allied pests of stored products are inherent in (1) their habit of breeding in obscure places; (2) their continual reintroduction into this country from abroad in infested cargoes; (3) their repeated dissemination in the course of domestic trade, from granary to warehouse, warehouse to mill or factory, and mill or factory to wholesale and retail depots; (4) their opportunity for undisturbed multiplication during periods of prolonged storage under war conditions.

In all the process of its transhipment, it is not an easy matter to safeguard edible merchandise against infestation, since there are so many points at which this may occur in its passage from its source through storage and manufacture to the ultimate consumer. In warm countries the initial infestation of cereals may occur in the field before the crop is harvested. Should they escape this contingency, they may, nevertheless, incur infestation in the farmer's barn, and, later, in railway or dock warehouses, before they are shipped elsewhere in railway cars or boats. And so it is, at every step in their handling, there is recurrent risk of infestation of stored products, which is continued through mill and factory to the shops, and invariably the cause is the same—neglect of the fundamental hygienic principle of cleanliness. Therefore, it cannot be too insistently urged that all quarters which are employed for the accommodation of stored products should be thoroughly disinfested before being replenished with fresh stocks.

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[1] Newstead, R., and Duvall, H. M., 1918. "Bionomic, Morphological, and Economic Report on the Acarids of Stored Grain and Flour." Reports of Grain Pests War Committee, Royal Society, No. 2.

Since the activities of insects is very much a function of temperature, it is essential that warehouses used for stored products should not be artificially heated and should be well ventilated. At 45° F. grain-infesting insects are dormant. As the temperature increases they become more and more active, breeding more rapidly and doing correspondingly greater damage to the grain. Heavily infested grain tends to heat, and the temperature of such grain, if left undisturbed, may ascend to 100° F. and over. Temperatures in excess of 63° F. should be taken as a warning that the threshold of danger has been reached and that the infestation is assuming destructive dimensions. Heating of infested grain is induced by the bacterial decay which proceeds in the frass and grain-dust that fills up the crevices between the grain and inhibits free ventilation.

In the early stages of an infestation, screening of grain serves to eliminate large numbers of insects, but eggs and larvæ that lie within the individual grains escape and persist. Screening should, therefore, be repeated at periods of about three months in summer in order to remove those insects which have arrived at maturity in the intervals and emerged from the grains.

Contact sprays, which have proved their worth in the control of insect pests of orchard trees, have given promising results in experimental trials on insect pests of stored products in mills and warehouses. Contact insecticides for indoor use differ from those employed out-of-doors in that they are mixed with a refined oil of the paraffin series instead of a soap solution. One of these which is commonly used has pyrethrum extract for its active principle. The insecticide is applied in an atomised condition to the walls of bins and to floors where insects are found. Contact sprays give the best results when applied in confined spaces ; doors and windows should, therefore, be kept closed whilst treatment of an infested store is proceeding.

A pyrethrum contact spray can be simply and effectively prepared by adding one pound of fresh pyrethrum insect powder to one gallon of refined paraffin oil. The mixture is stirred at intervals over a period of about two hours. The result is a clear lemon-yellow liquid containing the extract, with the pyrethrum residue forming a sediment at the bottom. The supernatant liquid is used as the spray. To prevent its deterioration it is poured into a tightly corked metal container until required.

By much the most effective means of dealing with insect infestations of stored products in warehouses and mills is fumigation, but, on account of the danger associated with the use of highly poisonous or inflammable gases, none but skilled operators should undertake fumigation, unless on a very small scale and with gases that are comparatively innocuous to human beings.

Efficacy of fumigation depends on the maintenance of a lethal concentration of gas over a period of twenty-four to forty-eight hours, and therefore the building or chamber to be treated must be gas-tight. Gas-proof chambers capable of taking large quantities of material can be more economically and efficiently treated than the average warehouse with imperfections all over its walls and roof, through which the fumigant gas may leak at random. In the absence of specially built chambers fumigation of a limited consignment of stored products can be effectively carried out under a tarpaulin. In flour and meal mills, however, where infestations of the Mediterranean Flour Moth and the Indian Meal Moth are apt to be generalised, the whole of the premises must be treated.

Temperature is a factor of importance where fumigation is concerned. Results are best when the treatment is conducted at a temperature of 70° F. or higher. The insects are activated and are then more susceptible to the poisonous properties of the fumigants. High concentration of carbon dioxide in infested grain and grain products also serves to accelerate the toxic effects of the fumigant by stimulating respiratory exchange in the insect.

Admixture with grain of certain mineral dusts, consisting of silica, rock phosphates, and precipitated chalk, have apparently given protection under experimental conditions. The method if effective under commercial conditions would commend itself because of cheapness, duration of protection, and ease of application unattended by poisonous hazards. When the grain is required for milling, the dusts are removed in the course of the routine cleaning to which the grain is ordinarily submitted.

Readers are advised that information concerning the identity of insects and allied pests of stored products, their habits and control, can be obtained from the Advisory Entomologist of one or other of the Colleges of Agriculture or from this Society.

AGRICULTURAL RESEARCH IN SCOTLAND IN 1941.

BEING A BRIEF SUMMARY OF THE WORK AT THE SCOTTISH AGRICULTURAL RESEARCH STATIONS DURING THE YEAR.

Readers desiring fuller information on any of the subjects mentioned should write to the Director of the Station at which the investigation is being carried out.

INSTITUTE OF ANIMAL GENETICS.

UNIVERSITY OF EDINBURGH, WEST MAINS ROAD.

Dairy Cattle.—The long-term breeding experiment on the inheritance of milk production is being maintained.

Pigs.—Individual and group-feeding experiments have been carried out on the use of home-grown feeding-stuffs. So far neither lop-eared pigs nor their crosses with the Large White have shown any greater appetite for bulky foods than the pure Large Whites. A small but successful trial was made with lawn cuttings mixed with potatoes and meal. In the proportions 7 : 12 : 1½ the daily gain was 1·23 lb. and the meal consumed per pound of gain was 1·04 lb. Pigs getting a mixture of equal parts of grass and potatoes without meal put on about 5 lb. per week. It was found essential that the grass should be short and succulent. An attempt to replace the grass with finely cut kale for winter rations did not give such good results.

In connection with post-war requirements of superior breeding stock and the desirability of making a concerted attempt to improve performance, it is of interest to find that the average duration of pedigree herds was only 3·6 years, and that 75 per cent of them lasted for a shorter period than that.

This is too short a time for constructive breeding to bear fruit.

Poultry.—Breeding investigations to determine the heritability of factors involved in high egg yields are being continued. Progress in the experiments relating to inheritance of body size and egg size has been made. Studies on the physiology of egg production has shown the importance of the thyroid gland at all stages of the egg-laying cycle.

ANIMAL DISEASES RESEARCH ASSOCIATION.

MOREDUN INSTITUTE, GILMERTON, MIDLOTHIAN.

Louping-Ill.—Louping-ill vaccine continues to prove successful in the control of the disease, and work is continuing with the object of evolving means for the simplification of its production.

Since the vaccine is not unattended with risk when applied to young lambs, field experiments are being carried out with the object of obtaining a means of lamb immunisation which is at once safe and effective.

Braxy.—Braxy vaccine has been issued for several years as a 'single-dose vaccine,' and continues to prove highly effective as a means of controlling the disease. It should be noted, however, that on farms on which braxy is particularly virulent the vaccination may with advantage be repeated after an interval of fourteen days.

White Scour in Calves.—Previous investigations have shown that calves born from cows whose colostrum is deficient in vitamin A. are predisposed to white scour, whereas calves receiving colostrum rich in vitamin A. are relatively insusceptible to the disease. It has been found, however, that no increase in the vitamin A. content of the colostrum can be effected when substances rich in vitamin A. or its precursor carotene (cod liver oil, grass silage, dried grass, or carrots) are fed to stalled cows during the winter.

In view of these results, experiments are being carried out to ascertain whether the administration of a vitamin A. concentrate to newly born calves will increase their resistance to the onset of white scour and its allied affections.

Lactation Tetany.—Lactation tetany—so-called 'grass tetany'—attacks cows usually in the early stages of lactation.

It has been shown that a hypomagnesæmia is associated with the disease, and there is now evidence that the feeding of a magnesium-rich mineral mixture for a few weeks before and after parturition appears to be of value in reducing the incidence of the disease. Further work on this matter is proceeding.

Scrapie.—Since there has been obtained evidence that scrapie is due to an infective agent, an experimental hirsel has been purchased and is being maintained for the purpose of studying the cause and nature of the disease. Because of the prolonged incubative period of scrapie, the investigation must be a lengthy one.

Pine.—It has now been definitely established that in certain districts pine can be both prevented and cured by the administration of cobalt.

There have been carried out further experiments to determine whether the application to affected pastures of cobalt-rich manures would raise the cobalt content of the herbage and so prevent the disease.

In collaboration with the Macaulay Institute for Soil Research and the North of Scotland College of Agriculture, a series of experiments was carried out; these showed that the cobalt content of deficient pastures could be raised in proportion to the richness of the respective dressings of cobalt chloride, and that a dressing of 2 lb. per acre was sufficient to render such pastures cobalt adequate.

From the results of a later controlled experiment, it was apparent that such treatment of cobalt-deficient land afforded means both for the prevention and cure of the disease.

While carrying out the above experiment it was found that dressing pasture with cobalt had the unexpected effect of increasing materially its molybdenum content. On fields in which the normal molybdenum content of the pasture is very low this increase is of no consequence, but where the normal content of molybdenum is high the increase which follows cobalt application might be of an order such as to render these pastures toxic to animals—molybdenum poisoning of calves ('teart') being well recognised in certain districts of England. The precise significance of this observation has not yet been determined and further work is in progress.

Pulpy Kidney Disease in Lambs.—Severe losses are each year experienced from pulpy kidney disease. This affection attacks lambs during the first few weeks after birth, and is due to a micro-organism closely related to that causing lamb dysentery.

An investigation of means for its prevention, particularly by the vaccination of the pregnant ewe, is being continued.

Cripples in Lambs.—As the result of a survey which was made in the spring of 1940 of the lamb mortality on tick-infested farms, it became evident that a considerable number of deaths resulted from joint-ill and other septic conditions, and that these conditions were largely due to infection with a specific staphylococcus.

An extensive study of a number of strains of this organism is in progress with a view to obtaining a specific method of prevention.

Parasitic Gastritis in Lambs.—At the instance of the Agricultural Research Council, the Institute has undertaken an extensive experiment to determine the most suitable dose and the best method of administering phenothiazine as an anthelmintic in sheep. The work has been carried out in collaboration with the Department of Natural History, Edinburgh University. Definite results of practical application have been obtained.

Johne's Disease in Sheep.—A study is being made of the strains of organisms concerned in the production of Johne's disease in the sheep and of biological tests which may be employed in the diagnosis of the disease.

Grass Sickness in Horses.—Much intensive research in grass sickness has been carried out, particularly from the biochemical aspect.

Histology and Hæmatology.—A very considerable amount of histological work has been carried out in respect of scrapie and grass sickness, and hæmatological studies have been made in connection with cobalt deficiency, the administration of phenothiazine to sheep, and ovine Johne's disease.

THE ROWETT RESEARCH INSTITUTE.

BUCKSBURN, ABERDEEN.

Silage.—Practical demonstrations of different methods of making silage have been continued. Young grass was conserved in (*a*) tower silos, (*b*) a converted building, and (*c*) in shallow pits. Although a complete examination has not been made the inedible wastage in the shallow pit is very small and not more than in the tower, while the great pressure in the tower seems to have resulted in a much greater loss of the valuable juices from the young tender grass. The advantages of the shallow pit method may therefore be more than confirmed, since it was formerly believed that the losses in the tower were less than by any other method.

An area of 2 acres of four-year-old ley, which had been cut for silage the two previous years, was cut three times in 1941 and the produce weighed and analysed. The weight was 15 tons per acre, and the grass had an average dry-matter content of 17 per cent, with a protein content of 14·5 per cent.

Soiling with grass of this character was again tried out with the cows in milk. The average consumption was about 120 lb. per day—half an acre per cow for the season. This confirms the results obtained in 1940. The experience of several farmers in Aberdeenshire in 1941 who have tried out this system has been that a cow can be maintained on ½-⅔ of an acre.

Sows of the Wessex Saddleback breed have been maintained up to the beginning of December on grass and potato silage. Those farrowed to date had litters above the average in health, and rearing has been very satisfactory.

Waste potatoes have been made into silage by different methods. A good product was obtained where raw potatoes were 'fingered' in a turnip cutter, mixed with about 5 per cent of chopped young grass and stored in a cement container or in a shallow earth pit. By this method waste potatoes collected during or after digging or while dressing is in progress could be saved when it is often a difficult problem to utilise them before they rot. A feeding experiment with growing pigs is in progress to determine the value of raw potato silage.

Iodinated Protein for Milk Cows.—An experiment was carried out during the summer to determine the value of iodinated protein in 'boosting' the yield of cows calved for three months or more. Graded doses were used and compared with the effect of injections of thyroxin. Preliminary examination of the results indicates that none of the treatments had any effect on the milk yield.

THE SCOTTISH PLANT BREEDING STATION.

CRAIGS HOUSE, CORSTORPHINE, EDINBURGH.

Experimental work on the breeding of cereals, potatoes, herbage plants, swedes, and kales is in progress at the Station. Each year it is customary to describe briefly in the

'Transactions' one section of the work, and on this occasion that dealing with herbage crops will be reviewed.

After the last war, when arable land was rapidly passing to permanent grass, the herbage plants most urgently required were those suitable as components of permanent pasture mixtures. The commercial varieties of the cheap grasses were considered by many to be insufficiently persistent and to possess too low a proportion of leaf to stem to be suited for this purpose. Accordingly at the Plant Breeding Station, which had just been established in 1921, attention was directed to the examination of plants which had long survived permanent grassland conditions, and, as a preliminary to systematic breeding operations, old Scottish pastures were searched for perennial ryegrass, cocksfoot, and timothy. As a result, it was not long before varieties possessing a much higher proportion of leaf to stem were produced; in fact, the process was carried so far in this direction that plants were obtained yielding little or no seed—a circumstance which, of course, made them worthless for practical purposes. Moreover, it was found that varieties bred from plants of the above-mentioned origin were without exception late in starting growth in the spring. Consequently, it was not surprising that when seeds mixtures comprising only these new varieties were sown, the results were not infrequently unsatisfactory on account of their lateness. Thus it became apparent that such late varieties could not be expected successfully to replace early varieties, nor could they by themselves, despite their greater persistence, supply the needs of the average permanent grassland farmer. When the previous herbage report in the 'Transactions' was written the permanent grassland situation had progressively deteriorated, and a considerable area of the land so utilised was little better than derelict. It was evident that under the system of stock-farming most commonly practised in the upland districts of Scotland the better grasses of cultivated land could not be maintained indefinitely at a satisfactory level of production without due consideration being given to their cultural needs. The most obvious remedy was to return this area to the arable acreage for a brief period of cultivation before again laying down to grass. But since the initial reason for laying down the land to permanent grass had been to escape the consequences of unremunerative arable cropping, any such proposals had, very naturally, little appeal. The alternative was to plough and reseed direct to grass, a method which has far-reaching implications.

Ploughing, followed by direct reseeding to grass, implies that an area permanently under grass need not necessarily be in *permanent grass;* it could equally well support successive short-term swards systematically renewed on the basis of productivity. Under such a system the conception of grass as a cultivated crop is applied to an area lying outside the rotational acreage. Thus the conversion of existing permanent grass, or the laying down of unwanted arable to what might for convenience be termed *successional grass*, raised interesting plant breeding problems. Firstly, there was the problem of grazing nurse crops to be considered. It is, of course, possible to obtain good results without sowing a nurse crop for the 'seeds,' but by so doing the unproductive period between sowing and grazing is unnecessarily prolonged. Among the quick-growing annual plants examined at the Scottish Plant Breeding Station for their value as grazing nurse crops, none has so far exceeded the usefulness of the 'Fodder' group of oats, including the variety 'Sandy.' Secondly, by introducing the factor of cultivation to grassland the number of the varieties of the potentially productive species which might be sown with some hope of success was considerably extended. Even the commercial varieties of, for instance, ryegrass, which under permanent grass had proved incapable of surviving beyond the time the beneficial effects of recent cultivation lasted, might well prove useful under these improved conditions.

An outstanding feature of the Society's successional grassland investigations has been the good results obtained by sowing the late and mid-late varieties, mentioned in connection with permanent grassland, together with the early commercial varieties which they were originally intended to replace. The use of mixtures of complementary varieties instead of mixtures of species would seem to have particular significance where a grazed nurse crop is employed which favours the rapid establishment of the seeds mixture. The part played by varieties of different growth periods in levelling out production during the season is well illustrated by the data recorded from a trial of ten timothy varieties. An early variety gave a heavier yield in May than any other, another gave the heaviest yield in June and again in August, and a late variety the highest yield in July and September.

These results reflect some of the recent tendencies in plant breeding research as they bear upon the important problem of grassland improvement. By transferring the emphasis from persistency to productivity—*i.e.*, from permanent grass to successional grass, greater use could be made of the varieties of the few species capable of high production.

THE WEST OF SCOTLAND AGRICULTURAL COLLEGE.

(a) ANIMAL HUSBANDRY DEPARTMENT.

Vinquish.—On three hill farms where losses occur in the sheep stock each year from Vinquish and other diseases, strips of pasture on the hefts have been dressed with basic slag and cobalt sulphate at the rate of 1 ton per acre and 10 lb. per acre respectively. To one heft a basic slag dressing has been applied without the addition of cobalt. Previous to treatment, soil analyses showed a large deficiency of lime and phosphate, a low cobalt content but an abundance of potash. Observations on the productivity and general health of the stock are being made and compared with the records in previous years and with adjoining untreated hefts.

Mineral mixtures of different composition and containing various levels of cobalt have been placed in boxes and distributed over hefts affected with Vinquish.

Dosing the flock with large amounts (30-50 mg. per head) of cobalt at the gatherings, which take place at monthly intervals during the summer, is being carried out on other affected areas.

The three methods of (1) manuring, (2) mineral feeding, and (3) dosing are being compared to determine their value in controlling the disease under conditions of practical hill sheep farming in the south-west.

Head Grit.—The lamb crop on a number of Ayrshire and Galloway farms is attacked annually from June onwards by a disease known locally as Head Grit, and characterised by jaundice and intense photosensitisation. Evidence has been obtained that the disorder may be nutritional in origin. Affected hefts have been selected and mineral mixtures containing various elements have been fed from lambing-time onwards. Observations are being made on the incidence of the disease on the different treated hefts with a view to obtaining information on the etiology of the disorder.

Mortality in Bacon Pigs.—A condition resembling Vertigo and Meniere's disease has been investigated in pig herds in Ayrshire. While the incidence is usually low, the symptoms develop when the animals are ready for slaughter, and their loss at this stage is serious. Specimens of affected brains are being examined in conjunction with the Royal Cancer Hospital with a view to (1) the establishment of cerebellar abscess as an essential lesion in animals showing the syndrome, and (2) the preparation of a bacterial vaccine from the isolated organisms as a prophylactic or therapeutic measure.

(*b*) MILK UTILISATION DEPARTMENT.

Use of the advisory services continues to be made by the milk producer and the dairy manufacturer.

The study of the causes of high bacterial numbers in the milk supplies of graded farms was continued throughout the year. Interdepartmental experiments of a co-operative nature were undertaken to test the accuracy of the methods of sampling and testing adopted by the inspectors of public health authorities. Complaint is frequently made that insufficient care is observed in the sampling and subsequent treatment of the official samples. From the results of our investigations there is no reason to believe that the milk producers are being in any way penalised by unfair practices. In the majority of cases examined the bacteriological results from the College and public health authorities agreed absolutely, and there was in no case any really significant divergence.

Advantage of this investigation was taken to compare the relative efficiency of different methods of sampling the milk supplies of producers at the creamery. Sampling from the creamery weight tank was found to be the simplest and easiest practice. The quality of any single supply was in no way seriously degraded by the preceding supply either on the score of bacterial count or coliform contamination.

Cheese Starters.—The examination of milks and lactic cultures from various sources for selected strains of lactic acid organisms of great virulence has been undertaken and continued throughout the year. The cultures issued from this department gave every satisfaction during the cheese-making season of 1941.

Utilisation of Cheese Whey.—Preliminary work on the manufacture of a new dairy product from cheese whey was described in last year's 'Transactions,' and its suitability as an alternative to buttermilk suggested. This work on whey was continued during the year, and further uses for the new product discovered. In a sweet unfermented form the whey product may be used as a substitute in domestic cooking and in ice-cream manufacture. Condensed sweetened and unsweetened forms have been prepared, and there would appear to be a selected use for the sweetened product in certain branches of food manufacture.

Butter and Cheese Manufacture.—The influence of certain kinds of silage on the quality of the butter and cheese manufactured from the milk of silage-fed cows was examined in a series of trials made in the late spring of 1941. The silage-fed butter was in no way inferior to the control group of butters, but there is reason to believe that the control group of cheese were slightly superior in flavour to the cheese made from the silage-fed milk.

Mastitis Milk.—The routine testing of the milks of individual cows of many farms was continued and farmers advised on the grouping of their cows to reduce the possibility of more widespread mastitis infection. In selected cases, where independent veterinary treatment has been administered, subsequent examination of the milk of the treated cows has shown very disappointing results.

An intensive study of the effects of mastitis on the general characters of the milk is being continued.

THE HANNAH DAIRY RESEARCH INSTITUTE.

Kirkhill, Ayr.

The Maintenance of the Milk Supply.—Quantitative studies have been made of the war-time milk supply, one covering Great Britain and a second dealing with the position as it affects Scotland. Both studies contain estimates of the home production, and indicate the probable level of liquid consumption and the balance likely to be available for manufacture. Methods of maintaining the milk supply at an adequate level are discussed, particular attention being directed to the increased use of home-grown feeding-stuffs, the use of milk substitutes for calf feeding, the control of those cattle diseases which affect milk yield, and the need for mobilising the country's resources for condensing and drying the surplus summer milk.

Farm Self-sufficiency.—In view of the importance of determining how far the supplies of home-produced protein-rich feeding-stuffs could be increased, a policy of self-sufficiency has been developed on the Institute's farm. During the year under review complete self-sufficiency has been attained, and it is notable that this has been achieved in addition to producing increased quantities of crops suitable for direct human consumption—*e.g.*, of oats and potatoes. The basis of the policy adopted has been a substantial increase in the productivity of the available grassland and the conservation of the resulting surplus grass herbage by ensiling or artificial drying. The use of soiling crops and of green catch-crops has also been developed, while the growing of beans and of linseed has provided further protein-rich feeds.

Work in connection with the use of synthetic non-protein nitrogen compounds, such as urea, as substitutes for protein has been continued, special attention being directed to the best means of incorporating such substances in compound feeding-cakes. The most satisfactory conditions for the storage of feeding-stuffs have also been investigated.

The Diseases of Dairy Cattle.—The two chief diseases responsible for lowered milk yield in cattle are contagious abortion and mastitis. The Institute has undertaken numerous diagnostic tests for contagious abortion at the request of veterinary surgeons and herd owners, and tests have been made of the value of live vaccines in the treatment of affected herds. As regards mastitis, control measures have been carried out experimentally in some sixty typical dairy herds. Over 65,000 diagnostic tests have been undertaken, and some 400 visits have been paid to co-operating farms. Various methods of treatment have been studied, and investigations have been made into the influence of certain environmental factors on the spread of the disease.

The Bacteriological Control of Milk.—Work has been continued on the relative values of the plate count and the modified methylene blue reduction test for assessing the hygienic quality of the milk supply. In general, remarkably close agreement has been found between the two tests, but there was a definite improvement in the correlation when the samples for both tests were subjected to identical storage conditions. A parallel study of the value of the new resazurin test showed close agreement with the methylene blue test, and gave somewhat quicker results when applied to poorer quality milks.

The Keeping Quality of Milk Powder.—The expansion in the home production of dried milk powder (as a means of conserving surplus summer milk for winter use) makes it specially important to devise suitable means of storage and so to prevent deterioration and waste. Methods of inert gas storage have now been tried out on a semi-commercial scale, with successful results. In addition, the use of antioxidants and of other means of prolonging the keeping quality of milk powders have been tested on a laboratory scale. The various factors affecting the miscibility (ease of solution) of such powders have also been investigated.

Studies have been made of the bacteriological condition of roller-dried milk powders and of certain other dried milk products (*e.g.*, dried buttermilk and whey). On the basis of the results it has been possible to suggest tentative standards of quality.

MACAULAY INSTITUTE FOR SOIL RESEARCH.

CRAIGIEBUCKLER, ABERDEEN.

The general work of the Institute was modified at the outbreak of war, and has been continued on modified lines, with special attention to advisory work and to problems of immediate practical importance.

Advisory Work.—The Institute undertakes the testing of soils on behalf of farmers in the North of Scotland, and advice on liming and manuring is given free of charge. During the year over 3600 samples of soil have been examined, and the results generally emphasise the need for widespread use of lime and phosphates. In spite of the Government subsidy on lime during the past few years, there is still a lime deficiency in the majority of the soils, and there is a very marked need for the increased use of lime. Old grassland which is being broken up for cropping is especially liable to be deficient in phosphate, but even in arable rotation land the phosphate supplies in the majority of the soils could with advantage be considerably increased.

General Soil Fertility Investigations.—General experimental work on the effects of lime and phosphate has been continued, with special reference to the problem of fixation of phosphate —*i.e.*, the processes resulting in the conversion in the soil of soluble or available phosphate into forms which are insoluble or unavailable to plants. Experiments have also been carried out on the time of application of superphosphate and on the conditioning of fertiliser mixtures. From a comparison of the results obtained with autumn and spring applications of superphosphate the conclusion is that on average agricultural land superphosphate can be applied in autumn or winter with little, if any, risk of its efficiency being reduced. If autumn or winter application of superphosphate, either to grazing land or to a ploughed surface, will enable delivery of the fertiliser to be taken at any time, it is well worth doing, especially where there is a lack of storage facilities. In connection with the general problem of storing fertilisers delivered out of season, promising results have been obtained with a mixture containing peat litter as a conditioning agent.

Spectrographic Investigations.—The relationship of trace element content of soil and herbage to animal diseases has been studied further, in particular with regard to cobalt deficiency. Results of this work, carried out in collaboration with the Animal Diseases Research Association, have been published, showing that where cobalt deficiency is definitely established it may be remedied by a manurial application of a cobalt salt.

Peat and Soil Organic Matter.—In some parts of the country, particularly in market gardening districts, there is an acute shortage of farmyard manure. Experiments have therefore been laid down to determine the value of peat reinforced with artificials as a substitute. Work on horticultural composts has been continued.

Soil Surveys.—The survey work has again been continued on a limited scale and assistance given in collecting samples for advisory purposes. Further work on the relation of soils to tree growth on areas where war-time felling is taking place was carried out.

Limestone Resources of Scotland.—The survey being made in co-operation with the Geological Survey is now nearing completion. War-time pamphlets on the limestones occurring in Banffshire and the North-East Grampians, the Central Grampians, and the South-West Highlands and Islands have been published. Other pamphlets covering East-Central Scotland and the Northern Highlands are in course of preparation.

MILK RECORDS.

THIRTY-NINTH YEAR—RECORDS OF 39,534 COWS.

By JAMES A. PATERSON, Secretary-Superintendent,
The Scottish Milk Records Association.

SYSTEMATIC milk recording in Scotland was continued in 1941 under the direction of the Scottish Milk Records Association on the same lines as in previous years, notwithstanding the fact that the Exchequer grant to meet administration cost was discontinued as from 31st March 1940. The Association were again fortunate in obtaining a grant at the rate of £500 per year from the Ayrshire Cattle Herd Book Society, and £100 per year from the British Friesian Cattle Society; the balance of the total cost to the Association to operate the Scheme being met by the members of the Milk Recording Societies.

The Association in 1941 consisted of the following members of Milk Recording Societies:—

Name and Address.	Body Represented.
Mr E. A. Bell, 2 Miller Road, Ayr	Central and South Ayrshire Milk Recording Society (6 Circuits).
Mr John Lockhart, Stair House, Mauchline	
Mr William Wallace, Lyonstone, Maybole	
Mr R. H. U. Stevenson, Corseclays, Ballantrae	
Mr M. Semple, Sandhill, Drongan	
Mr George Templeton, Carnell Home Farm, Hurlford	Central Ayrshire No. 2 Milk Recording Society.
Mr James M‘Call, The Broom, Stirling	Central Scotland Milk Recording Society (6 Circuits).
Mr J. C. Lohoar, Whitlawburn, Cambuslang.	
Mr T. C. Stewart, Southfield, Kirkmuirhill	
Mr Thos. Johnstone, Standalane, Falkirk	
Mr M. Bowie, Balmuildy, Maryhill	
Mr W. M‘Lachlan, East Crookedstone, Quarter	
Mr Robert Watt, Milligs Farm, Helensburgh	Dumbartonshire Milk Recording Society.
Mr M. Sloan, Hunterhouse, Lochmaben	Dumfriesshire Milk Recording Society (3 Circuits).
Mr J. Stevenson, Muiryhill, Durisdeer	
Mr John Johnstone, Millantae, Lockerbie	

Name and Address.	Body Represented.
Dr Chalmers Watson, Fenton Barns, Drem, East Lothian	East Lothian and Border Milk Recording Society.
Mr James W. Clement, East Pitkierie, Anstruther	Fife Milk Recording Society (2 Circuits).
Mr G. W. Lambie, Nether Pratis, Leven	
Mr Angus Matheson, Drakies, Inverness	Highland Milk Recording Society.
Mr John T. Kirkwood, B.Sc., N.D.A., Scorrieholm, Lesmahagow	Lesmahagow Milk Recording Society.
Mr John Wallace, Whitehills, Sorbie	Machars Milk Recording Society (2 Circuits).
Mr Robert Laird, Lawthorn, Irvine	North Ayrshire (John Speir) Milk Recording Society (3 Circuits).
Mr J. M. Matthew, Girthill, Saltcoats	
Mr Thomas Murdoch, West Tannacrieff, Fenwick	
Mr J. R. M'Caw, Douneside Home Farm, Tarland	North of Scotland Milk Recording Society (3 Circuits).
Mr Robert Howie, Flatterton, Greenock	Renfrew and Bute Milk Recording Society (2 Circuits).
Mr John Raeside, Hattrick, Kilmalcolm	
Mr John Forster, Mains of Larg, New Luce	Rhins of Galloway Milk Recording Society (3 Circuits).
Mr J. M. Gilmour, Chapelton, Borgue	Stewartry Milk Recording Society (4 Circuits).
Mr J. G. Baird, Kirkchrist, Kirkcudbright	
Mr George Barbour, Auchengibbert, Crocketford	
Mr John Corrie, Park of Tongland, Castle Douglas	
Col. W. T. R. Houldsworth, Kirkbride, Maybole	The Ayrshire Cattle Herd-Book Society of Great Britain and Ireland.
Mr A. W. Montgomerie, Westburn, Cambuslang	
Mr James Howie, Muirside, Dumfries	
Mr A. B. Fowler, Ph.D., B.Sc., Kirkhill, Ayr	
Mr William Montgomery, North Milton, Kirkcudbright	The Highland and Agricultural Society of Scotland.
Mr James Kilpatrick, Craigie Mains, Kilmarnock	
Mr James Wither, Awhirk, Stranraer	
Mr James Kilpatrick, Craigie Mains, Kilmarnock	The British Friesian Cattle Society.
Mr A. M'Intyre, Dunallan, Rothesay	
Mr James Dunlop, Midland, Prestwick	The West of Scotland Agricultural College.
Mr J. S. Stevenson, Balig, Ballantrae	
Principal W. G. R. Paterson, 6 Blythswood Square, Glasgow	
Dr A. M. Smith, 13 George Square, Edinburgh	The Edinburgh and East of Scotland College of Agriculture.
Dr A. Cunningham, 13 George Square, Edinburgh	

Name and Address.	Body Represented.
Dr J. F. Tocher, 41½ Union Street, Aberdeen	The North of Scotland College of Agriculture.
Professor J. Hendrick, Marischal College, Aberdeen	
Mr Arthur R. Wannop, B.Sc., B.Eng., 41½ Union Street, Aberdeen	
Mr John Forster, Mains of Larg, New Luce .	Animal Diseases Research Association.
Mr W. Cassels Jack, Glenpark, Braxfield Road, Lanark	
Dr Norman C. Wright, M.A., Ph.D., Kirkhill, Ayr	The Hannah Dairy Research Institute.
Dr A. B. Fowler, Ph.D., B.Sc., Kirkhill, Ayr	
Sir Hugh Shaw-Stewart, Bt., K.C.B., Ardgowan, Inverkip	Co-opted Members.
Lt.-Col. W. Guy Shaw-Stewart, Ardgowan, Inverkip	
Lord Rowallan, Rowallan, Kilmarnock . .	
Mr John Speir, 81 Hope Street, Glasgow .	
Mr Alan Barr, Hobsland, Monkton . .	

Chairman—Col. W. T. R. Houldsworth.

The following were the principal members of the staff :—

Superintendent-Secretary—Mr James A. Paterson.

Assistant Superintendent—Mr Percy H. Hart.

SCHEME OF OFFICIAL MILK RECORDS.

ADMINISTRATION.

In 1941, as in previous years, the scheme of official milk records was administered by the Association through local milk recording societies. During the latter part of 1940 and the earlier months of 1941 every effort was made to obtain new members for local societies throughout the various dairying districts of Scotland, and a number of new members were enrolled. For various reasons, such as members disposing of their dairy herds or removing from their farms, &c., resignations were somewhat greater than usual.

All the local societies which operated in 1940, with the exception of one, continued in 1941. The number of recorders' circuits in 1941 was 39, 2 less than in the previous year. The number of herds officially tested was 816, and the number of cows officially tested, 39,534, a decrease of 47 herds and 1344 cows from the previous year. The following is a list of the milk recording societies which operated in 1941, with the name and adress of the Secretary of each society :—

Name of the Society.	Secretary.
Central and South Ayrshire (6 Circuits)	Mr E. A. Bell, M.A., B.Sc., 2 Miller Road, Ayr.
Central Ayrshire No. 2 .	Mr James Caldwell, Moorfield, Kilmarnock.
Central Scotland (6 Circuits)	Mr Arthur Gilmour, C.A., 23 Silvergrove Street, Glasgow.
Dumbartonshire . . .	Mr Robert Bilsland, Quay Place, Dumbarton.
Dumfriesshire (3 Circuits)	Messrs Henderson & Mackay, Solicitors, Lockerbie.
East Lothian and Border.	Messrs Inglis, Orr, & Bruce, 19A Hill Street, Edinburgh.
Fife (2 Circuits) . . .	Mr F. Dow, Commercial Bank, Thornton, Fife.
Highland	Mr J. M. Hunter, Queensgate, Inverness.
Lesmahagow	Mr James Hamilton, Auldtoun, Lesmahagow.
Machars (2 Circuits) . .	Mr William Christison, Barglass, Kirkinner.
North Ayrshire (John Speir) (3 Circuits)	Mr George F. F. Smith, Union Bank, Kilmarnock.
North of Scotland (3 Circuits)	Mr Robert C. May, Advocate, 77 Crown Street, Aberdeen.
Renfrew and Bute (2 Circuits)	Mr Thomas Hunter, Solicitor, 35 High Street, Paisley.
Rhins of Galloway (3 Circuits)	Mr W. Brown Moir, 8 Bridge Street, Stranraer.
Stewartry of Kirkcudbright (4 Circuits)	Mr Patrick Gifford, Solicitor, Castle Douglas.

SEASON 1941.

The following table shows for each society or circuit the number of herds, the number of cows tested, the average interval between tests, and the duration of the recording season :—

[TABLE.

Name of the Society or Circuit.	No. of Herds.	No. of Cows Tested.	Average interval between Tests, in Days.	Duration of Recording Season, in Weeks.
Central and South Ayrshire—				
1. Ayr and Troon	22	909	28	52
2. Coylton and Ochiltree	22	819	28	52
3. Cumnock	21	771	28	52
4. Girvan	22	1035	28	52
5. Kilmarnock	20	798	26	52
6. Maybole	22	1046	28	52
7. Central Ayrshire No. 2	23	907	28	52
Central Scotland—				
8. Carluke and District	19	799	25	52
9. Dunblane and District	21	885	28	52
10. Falkirk and Linlithgow	18	604	24	52
11. Kintyre and Renfrew	20	833	28	52
12. Strathaven and District	19	843	25	52
13. Strathendrick	16	1072	25	52
14. Dumbartonshire	24	958	28	52
Dumfriesshire—				
15. Dumfries—No. 1	22	956	28	52
16. „ No. 2	22	1011	28	52
17. „ No. 3	23	1072	28	52
18. East Lothian and Border	24	1243	28	52
Fife—				
19. Dunfermline and Kirkcaldy	21	973	28	52
20. Cupar-Fife and Perth	23	1058	28	52
21. Highland	21	751	28	52
22. Lesmahagow	24	957	28	52
23. Machars—No. I.	17	906	24	52
24. „ No. II.	16	826	25	52
North Ayrshire (John Speir)—				
25. Fenwick	21	1052	28	52
26. 'John Speir'	23	965	28	52
27. Stewarton and Montgomerie	21	896	28	52
North of Scotland—				
28. Aberdeen, Kincardine and Angus	21	1210	28	52
29. Aberdeen, Moray and Banff	24	1501	28	52
30. Aberdeenshire	22	1033	28	52
Renfrew and Bute—				
31. Bute	17	492	23	52
32. Paisley and District	20	838	26	52
Rhins of Galloway—				
33. Kirkcolm and District	20	1373	28	52
34. Kirkmaiden and District	15	1353	28	52
35. Luce Valley	20	1379	28	52
Stewartry of Kirkcudbright—				
36. Dalbeattie and New Abbey	23	1379	28	52
37. Castle Douglas and District	23	1404	28	52
38. Kirkcudbright and District	23	1352	28	52
39. Borgue, Twynholm & Gatehouse	21	1275	28	52
Total No.	816	39,534	...	...

DEFINITIONS.

The milk records compiled by the Association are records of the estimated quantity of milk produced by each cow in a separate lactation, and of the estimated percentage of milk fat contained in the milk. For convenience, a gallon of milk is reckoned as 10 lb. A gallon of milk of average quality weighs almost exactly 10½ lb. The following further particulars concerning each record were also given wherever possible :—

Name of cow, byre number, and herd-book number.
Sire of cow and herd-book number of sire.
Dam of cow and herd-book number of dam.
Date of birth.
Date of calving preceding opening of record.
Number of weeks in milk.
Date of calving after record closed.

The following particulars of the preceding record were appended to each record, where available :—

Date of calving preceding opening of record.
Quantity of milk in gallons.
Percentage of fat in milk.
Number of weeks in milk.

The milk yields were estimated in respect of quantity and milk-fat percentage from the results of systematic periodic tests by trained recorders approved by the Association. The recorders visited the farms for this purpose at intervals varying from twenty-one to twenty-eight days, and each day of visit was regarded as the middle day of the period covered by the test. Milk records estimated in this way approximate closely to the actual milk yields.

METHOD OF RECORDING—OFFICIAL RECORDS.

A distinctive feature of milk recording in Scotland in 1941, as in previous years, was that the official records were entirely the work of trained official recorders. Recorders had previously to undergo a special course of training in milk recording at the West of Scotland Agricultural College or other approved College of Agriculture. Only candidates of good character and good general education were selected to attend these courses ; and all recorders before appointment were approved by the Executive Committee of the Association.

All dairy farmers taking advantage of the Association's scheme were arranged into Local Milk Recording Societies employing one or more recorders, the Executive Committee having power to transfer members from one local society to another, in order to find accommodation for new applicants, and at the same time avoid overlapping of recorder's circuits. Each local society applying to the Association for licence to conduct milk recording under the Association's scheme signed the form containing the Association's rules and regulations, and agreed to conform to these rules. The local society selected and appointed their recorder or recorders from the list of approved recorders obtained from the Association. Apparatus, chemicals, sheets, and books were selected and arranged for by the Association, all byre sheets and record books used by the recorders being supplied free of charge. Thus uniformity of method was, as far as possible, assured.

The official recorder visited each herd at intervals of not more than twenty-eight days. He, or she, arrived at the farm in the afternoon, usually by means of a small pony and trap provided by the local society for the purpose, or by motor-car, and was accommodated at the farm overnight. All cows giving milk in each herd, as far as was possible, were included in the records. Each cow was clearly distinguished in the byre by a stall number on the wall, immediately in front of and above the level of the cow, and registered animals were also indelibly tattooed on the ears with distinctive registered tattoo markings. The cows were milked in the same rotation, evening and morning, on the occasion of the recorder's visit. The recorder weighed and sampled the milk of each cow in the evening, noting the time at which each cow was milked, and entered the results in the corresponding columns in the byre sheet, taking up a position in the byre as near to the milkers as possible, so as to have them in full view, and, as far as practicable, receiving the milk direct from the milker at the cow's side. He again weighed and sampled the milk of each cow in a similar manner in the morning, and entered the results in the byre sheets. He then tested the mixed evening and morning proportionate sample for each cow by the Gerber method for percentage of milk fat. He entered in the byre sheet any unusual conditions likely to affect the milk yields. The recorder was required to see that all milk samples and byre sheets were securely locked up overnight or during his absence. From the daily results the recorder calculated and completed the byre sheets, multiplying the yields by the exact number of days which had elapsed since the last test, but so calculating throughout that each day of the visit was regarded as the middle day of the period covered by the test. Special ready-reckoners were used to facilitate calculating and to ensure greater accuracy.

The byre sheets were written out in duplicate. The principal copies were posted at regular intervals to the office of the Association, and the second copies left with the respective members. The recorder transferred the results from the extended byre sheets to the milk record book for the herd indelibly in ink, each cow being assigned a separate page, at the top of which full particulars of the cow were entered, including the indelible tattoo marks on the animal.

Visits of inspection were made to each recorder and to the members of local societies at the different farms periodically throughout the year by members of the Association's staff, and reports thereon submitted to the Executive Committee. The Executive Committee reserved the right to withdraw approval of any recorder at any time, or to limit the period of service of any recorder with any particular society. Members of local societies refusing to observe any of the rules of the Association, or deemed to be guilty of conduct injurious to the true interests of milk recording, were liable to be temporarily or permanently suspended.

Another distinctive feature was the surprise check tests, the records of each herd being checked in this way about two times throughout the year. The recorder was instructed by a letter from the superintendent on a date unknown to recorder and owner of herd, to remain at the same farm another day and make another complete twenty-four hours' test. The surprise test results were entered on special buff-coloured byre sheets, and in the record books in red ink immediately below the results of the regular test of the previous day. The buff byre sheets were posted to the Association's office with the other sheets, and any abnormal differences were immediately noted and were reported to the Executive Committee.

As a result of this system of surprise check tests, each page of the 1941 milk record books contains entries in red, comparison of which with the immediately preceding entries provides valuable evidence as to the genuineness of the milk records.

In addition to the surprise check tests made by the recorder, a number of independent surprise tests were made by the Association's staff in order to check the recorder's work. A number of surprise re-tests of the milk samples already tested by the recorder were also carried out; for this purpose recorders were instructed to retain the milk samples each morning till ten o'clock.

All records were closed at the end of December, the current lactations being carried forward to the new books of the following year. Finally, summary sheets were written out in duplicate showing the total milk yield for each cow for the lactation or part lactation, with full particulars of the cow, dates of calving, &c. The principal copy of the summary sheet was posted to the Association's office with the record book, and the second copy left with the owner of the herd.

All record books and summary sheets were carefully revised, corrected in detail, and initialled in the Association's office during the next few months, the record books being returned later to the respective members, and the summary sheets retained and bound for future reference.

The milk records were next classified into three groups for cows and heifers respectively on the following basis. Experience has confirmed the view that the most useful comparison is obtained by reckoning the yields in terms of pure butter fat. Such a comparison takes into consideration both the quantity and quality of the milk.

Cows with a milk record equivalent to not less than 280 lb. of butter fat, and heifers with a milk record equivalent to not less than 224 lb. of butter fat, were grouped into Class I. Cows and heifers with milk records of less than two-thirds of these amounts—viz., 186 and 149 lb. of butter fat respectively—were grouped into Class III.

The following short table shows the corresponding values of these yields in fairly good milk of 3·5 per cent milk fat:—

Class.	Yield of Butter Fat. (Lb.)	Corresponding Yield in Milk of 3·5 per cent Fat. (Gallons.)
Cows in Class I.	Not less than 280	800
Heifers in Class I.	Not less than 224	640
Cows in Class III.	Less than 186	531
Heifers in Class III.	Less than 149	426

All cows and heifers with milk yields falling between these limits would come into Class II. Such animals naturally claim less attention than the good milkers or the obviously unprofitable animals. It should be noted, however, that Class II. would include a certain number of unclassifiable yields, as there were a number of cases where, from various causes, the results of a whole normal lactation could not be obtained.

It should be noted that while the above standards for classification of milk yields are the same as for 1934 onwards, they are higher than those formerly adopted, in the proportion of 280 lb. of butter fat for a Class I. cow to the former standard of 250 lb., the other standards bearing the same relation as formerly to the cow Class I. standard. This decision of the Executive Committee brought the Class I. standard for cows and heifers respectively into line with those adopted since 1924 for the Association's Annual Register of High-yielding Cows. This subject was dealt with more fully in the 1934 report under "General Review."

It should always be kept in mind when making a comparison of cows in different herds or in different districts that the different methods of dairying practised have a considerable influence on the milk yields, and that therefore milk yields alone do not necessarily indicate the true relative inherent or hereditary milking qualities of the animal. But the authenticated milk records compiled by the Association are of inestimable value to breeders and owners of dairy cows if properly interpreted.

REVIEW—OFFICIAL MILK RECORDS.

Recording was carried on in 1941 by 39 local societies or circuits comprising 816 members. The number of cows tested in 1941 was 39,534, compared with 40,878 in 1940.

Thirty-three women recorders were employed in 1941, and 18 men recorders. The Committee are again indebted to the West of Scotland Agricultural College for giving special courses of instruction for milk recorders to meet the Association's requirements. Two special courses were required in 1941, one in September, and one in November. Twenty-two selected candidates attended, and 17 obtained the certificate.

The Executive Committee purchased the supplies of milk-testing apparatus, sulphuric acid, and amylic alcohol for local societies, as in previous years.

The system of surprise check tests, introduced in 1920, was continued for a part of 1941. The total number of check tests made by recorders during the season was 297. In no instance in 1941 was the average milk yield for the herd more than 3 lb. milk daily less on the occasion of a check test as compared with the previous day. In addition to the surprise tests arranged for and carried out by the recorders, the Assistant Superintendent made 66 special check tests of different herds. The results in most instances agreed very closely in regard both to average milk yields and fat percentages with those of the recorders' previous tests.

PROSPECTS FOR MILK RECORDING.

Very little can be said in regard to the immediate prospects of the Association's scheme of milk recording, but it is hoped to continue the scheme on the same basis under which it was possible to work in 1941. Efforts similar to those of previous years were made to obtain new members for local societies in

1942, and the number of new members obtained for season 1942 to date is 38. A number of resignations have been received. The number of recorders' circuits has been reduced by two. The Central Scotland Society reduced their circuits from six to five, also the Fife Society from two circuits to one. The number of recorders' circuits in 1942 is 37, compared with 39 in the previous year. The total number of herds being officially recorded at the end of April is 770 as compared with 816 in 1941, but the total number of cows tested may show more than a corresponding reduction.

In certain cases the feeding-stuff rationing scheme is being put forward by farmers as a reason for discontinuing milk recording, but it is being pointed out to these farmers that there is now a very real reason why milk recording should be practised, as it is only by the systematic weighing and sampling of milk yields of individual animals that economic and adequate feeding can be arranged.

The position in regard to milk recorders is at the moment fairly satisfactory. The bulk of the men recorders have now been called up for military service, and their places have been taken by women recorders. All vacancies to date have been filled, and there remain a few approved recorders on the waiting list.

The Committee have also been able to arrange for the necessary supplies for local societies of sulphuric acid, amylic alcohol, and milk-testing apparatus for 1942, although for all these items a somewhat increased price will require to be paid. The question of the supply of sulphuric acid has been giving the Committee some concern, but the position now seems to be very much easier, and the manufacturers have indicated that they anticipate that no great difficulty will arise in the immediate future.

Systematic milk recording, or herd-testing as it is termed in some countries, has undoubtedly proved of great value to the dairy farmers in Scotland and elsewhere who have regularly practised it. There is no need to elaborate this point at the present day. Effective as it is in peace-time, there is even more need to maintain and extend the practice in time of war, to ensure, as far as possible, that the dairy cows kept produce milk in sufficient quantity and in the most economical manner.

Milk recording enables a dairy farmer to progress by the three main avenues: (1) thorough weeding; (2) economic feeding and more efficient management generally; (3) skilful breeding. The first two of these are of particular importance at all times, but even more so in time of war. Special difficulties to be surmounted will be shortage and high cost of suitable cattle feeding-stuffs and of efficient dairy farm labour. Under these conditions the dairy farmer will still consider he is better off with empty stalls than with cows producing at a loss. Thus, he will wish, more than ever, to eliminate unprofitable cows from his herd. But skilful breeding for milk production, in the light of the milk records obtained, is no less important as a well-directed effort to increase the proportion of good milkers in the cows that are kept. A reduction in the total number of dairy cows in the country is, for various reasons, almost inevitable in years of war, and such reduction will fall to be made good by worthwhile cows when peace returns.

ANALYSES FOR MEMBERS DURING 1941.

By Dr J. F. TOCHER, Aberdeen, Analyst to the Society.

DESPITE the abnormal conditions, or perhaps because of the abnormal conditions, a large number of samples has been analysed by me during the year 1941. The following is a summary of the results of analyses and the chief features of the reports made to members.

FERTILISERS.

Of the fertilisers analysed, eleven were compounds prepared for use as turnip, potato, and grass manures. The following table (Table I.) gives the results of analyses of the compound fertilisers :—

TABLE I.

	Nitrogen.	Soluble phosphoric acid.	Insoluble phosphoric acid.	Potash.
Potato manure . . .	5·00	8·26	4·06	6·21
Potato manure . . .	5·08	9·19	1·22	9·83
Potato manure . . .	6·21	5·80	4·15	7·96
Potato manure . . .	6·06	5·53	3·95	7·68
Turnip manure . . .	3·41	9·60	2·78	..
Turnip manure . . .	4·00	8·60	4·32	..
Corn and potato manure .	5·47	11·00	0·64	6·16
Special manure . . .	3·50	13·10	1·00	..
Compound manure . .	6·58	6·09	4·03	8·72
Manure	4·33	8·09	3·46	6·36
Manure	4·30	7·54	3·70	6·51

Other fertilisers analysed included superphosphates, slags, ground limes, limestones, and waste products. It is natural that in war-time waste products found to be of value should be used both as fertilising and as nutritive constituents. One of the samples received was a waste product containing as high a proportion of nitrogen as 8·4 per cent, together with 7·5 per cent insoluble phosphoric acid, equivalent to 16 per cent tricalcium phosphate. The waste product was, therefore, very useful as a fertiliser. A sample of floor sweepings was found to contain 3·3 per cent nitrogen and 8·7 per cent phosphoric acid in addition to 5·25 per cent potash. The samples of limestone analysed were found to be of very good quality, one sample containing as much as 98·3 per cent of calcium carbonate.

I am informed that the fertiliser supply position as a whole is very satisfactory, considering labour and transport difficulties, and also the increased acreage to be manured. The supplies of nitrogenous fertilisers, such as sulphate of ammonia, nitrate of soda, and nitro-chalk, should meet all requirements. I am further informed that the increased tonnage of superphosphate and slag should be sufficient for all crops if used properly. Ground mineral phosphate will not be applied to any great extent as a straight fertiliser or mixer, as most of it will be made into superphosphate. The phosphate rock considered most suitable for straight use is that which comes from Curacoa, a small island in the Dutch West Indies. Supplies of potash, on the other hand, are not sufficient to meet all demands. Potatoes and sugar beet, which need potash, are receiving priority. Other crops on potash-deficient soils will get dressings only when the priority crops are covered. Considering shipping hazards, however, the tonnage of potash now in the country is more than could have been hoped for at one time, and reflects great credit on those responsible.

To conserve supplies so that they may be put to the best use, certain ratios between nitrogen, phosphate, and potash in compound fertilisers have been established. Manufacturers and merchants have been informed of these ratios. The total capacity of all works for the manufacture of compound fertilisers is only 100,000 tons per annum. It is, therefore, imperative that the first compounding should go out as early as possible so that decks may be cleared for the second batch. It is clearly necessary that all farmers who have suitable storage accommodation should take in their supplies at once.

FEEDING-STUFFS.

The feeding-stuffs analysed included samples of the National cattle, pig, and poultry foods and also samples of meat and bone meal, oat husk meal, whale meal, ensilage, hay, linseed, and sugar beet. The proportion of sugar found in the sugar beet examined was 15·9 per cent, compared with seasonal averages of from 15·7 to 17 per cent found in this country in recent years. A sample of dairy cake was sent to me in order that I might determine its nutritive value and also examine it for any foreign substances which might cause illness among live stock. The sample was examined for castor seed, mustard seed, arsenic, lead, and other poisons, with entirely negative results. I reported that no foreign substances could have been the cause of the diarrhœa, lowered milk yield, or loss of appetite. These were the symptoms observed in the dairy herd. The cake was found to contain cotton seed and cereals, and was rich in albuminoids and oil. Since cotton seed was found present it was possible—other causes being excluded—that the illness might have been due to this rich vegetable feeding-stuff. Several cases of illness and death have occurred at various times as a result of feeding cotton cake and cotton meal. It has been proved that the poisonous action of cotton seed is due to the presence of a small proportion of a toxic poison in cotton seed kernels—namely, gossypol. Papers have been published discussing methods of rendering active seed kernels non-toxic by the destruction of the active principle or by changing it into a physiologically inert form. A determination of the amount of gossypol present would, however, require a special investigation on a very large sample of cake. A sample of whale meal was found to be very rich in oil and albuminoids, while a sample of white fish meal was found to be rich in albuminoids and phosphoric acid.

A sample of a feeding meal was found to be rancid, due to being damaged stock. I reported it as useless for feeding purposes. Another sample of feeding meal was found to contain a normal proportion of fibre, while other samples contained fairly high proportions of fibre. The ensilage examined was found to be of fair quality, although the proportion of moisture present was rather high. A sample of ground seed was found to be of good quality. A complete analysis was given, and a determination was made for the amount of iodine present. Quite a distinct trace of iodine was found. A sample of treated straw fodder contained a low proportion of albuminoids and a fairly high proportion of fibre. A waste product was analysed, and was found to consist of weed seeds and oat dressings. The sample contained 10 per cent of albuminoids. The only disadvantage was that it contained over 3 per cent of siliceous matter. I reported the sample as having a fairly high nutritive value.

A Ministry of Food Order gives the following percentage composition of the nutrients in pig foods :—

> "Pig Food (No. 1) should contain as a maximum 4 per cent of oil. The minimum allowed for albuminoids is 16 per cent, with 18 per cent as a maximum. The maximum for fibre is 7 per cent."
>
> "Pig Food (No. 2) (for fattening) should contain as a maximum 4 per cent of oil, 15 per cent of albuminoids, and 7 per cent of fibre."

A sample of Pig Food (No. 1) was found to contain 3·6 per cent of oil, 26·8 per cent of albuminoids, and 6 per cent of fibre; while a sample of Pig Food (No. 2) contained 5·2 per cent of oil, 26 per cent of albuminoids, and 5·6 per cent of fibre. The proportion of albuminoids was too high in both cases, while the proportion of oil in Pig Food (No. 2) was also too high. The proportion of fibre was satisfactory in both samples.

Samples of oat feeding meal were analysed, and were found to contain varying proportions of fibre. Oat husk meal is now classified among the miscellaneous feeding-stuffs in Part C. of the Feeding-Stuffs (Maximum Prices) Order of 24th November 1941. It is not, however, included in the Schedule which specifies the ingredients of compound feeding-stuffs and concentrates. A list of cereals is given showing those which may be used in the manufacture of compounds, provided the cereal or by-product of the same contains not more than 16 per cent by weight of fibre. Members of the Society have written me regarding certain definitions in this Order. At their request I have appealed to the Central Authorities, so that it may be made clear what cereal by-products may or may not be used in compounds.

The following table (Table II.) shows the composition of the feeding-stuffs analysed :—

TABLE II.

	Oil.	Albuminoids.	Phos. acid.			
Whale meal	12·86	62·94	4·35			
Bone and meat meal	8·94	38·44	15·50			
			Soluble carbohydrates.	Fibre.	Ash.	Moisture.
Kiln dried ground nuts	47·30	21·50	10·60	5·32	4·11	11·17
Ground seed	3·78	7·56	34·09	35·85	6·19	12·53
Dairy cake	4·48	21·63	..	9·00	..	..
No. 1 Layers' mash	4·05	17·31	..	5·23	..	..
Layers' mash	3·75	18·22	..	6·63	..	..
National poultry food, No. 1A	4·32	20·44	..	4·01	..	..
Mash	3·82	16·38	..	9·95	..	..
National cattle food, No. 1	3·67	21·00	..	6·73	..	..
Pig food, No. 1	3·63	26·83	..	6·08	..	..
Pig food, No. 2	5·15	25·97	..	5·57	..	..
Pig food	4·77	26·37	..	6·01	..	..
Pig food	4·62	20·88	..	6·12	..	..
Pig meal, No. 2	3·10	16·50	..	5·95	..	..
Oat feeding meal	..	..	..	15·48	..	..
Oat feeding meal	..	..	..	23·83	..	..
Oat feeding meal	..	..	..	28·70	..	..
Crushed oats	4·00	10·13	..	9·09	..	..
Beet and oat husk meal	0·44	6·13	..	21·48	..	..
Ground weed seeds and oat dressings	2·13	9·75	..	12·01	..	..
Linseed	39·06	..	..	..	..	..
Straw fodder	0·62	1·12	19·26	19·87	2·45	56·68
Ensilage	0·68	3·15	7·37	7·28	1·44	80·08
Sugar beet	0·02	1·75	16·79*	1·13	0·87	79·44
Hay (as received)	..	8·38	..	..	..	20·93
Hay (as received)	..	7·59	..	..	..	22·20
Hay (as received)	..	8·53	..	..	..	26·70
Hay (moisture free)	..	10·60	..	..	..	..
Hay (moisture free)	..	9·75	..	..	..	..
Hay (moisture free)	..	11·64	..	..	..	..

* Containing total sugar, 15·90 per cent.

I am now in a position to conduct feeding experiments on live stock using silage made from young bracken. I have commenced an investigation on mature bracken, undertaken to ascertain whether or not there is a poisonous or injurious substance present which could account for the reputed illnesses supposed to be brought about by cattle eating bracken. This is not a chemical problem which can be easily solved, but I will do my best to solve it.

Milks.

Among the samples of milk analysed during the year, eight were below the prescribed presumptive limit of 3 per cent butter-fat, five were below the prescribed presumptive limit of 8·5 per cent solids-not-fat, while six were below the prescribed presumptive limits in both butter-fat and solids-not-fat. Mastitis was found to be the cause of the deficiencies in a few of the cases.

The following table (Table III.) gives the results of analyses of the samples sent in for complete analysis. Twenty-two samples were sent in for analysis for butter-fat only :—

Table III.

No.	Fat, per cent.	Solids-not-fat, per cent.	No.	Fat, per cent.	Solids-not-fat, per cent.
1	2·65	8·88	15	3·20	6·87
2	2·05	8·25	16	4·00	9·06
3	2·10	8·96	17	4·10	8·92
4	2·95	8·21	18	4·45	8·80
5	2·45	7·90	19	5·05	8·10
6	3·00	6·67	20	2·40	8·96
7	2·38	8·66	21	3·80	8·56
8	2·50	9·06	22	4·15	6·52
9	3·00	8·82	23	3·70	9·40
10	1·93	8·76	24	3·13	8·70
11	2·33	7·88	25	2·85	9·43
12	2·75	7·90	26	4·60	9·18
13	4·16	8·43	27	1·40	8·73
14	2·65	6·71	28	8·20	9·54

The following table (Table IV.) shows the nature of the distribution of butter-fat and solids-not-fat in the samples received :—

[Table IV.

TABLE IV.

Butter-fat percentage.	Frequency.	Percentage of the total.	Solids-not-fat percentage.	Frequency.	Percentage of the total.
1 to 2	2	4	6·5 to 7·0	4	14·3
2 to 3	16	32	7·0 to 7·5	..	..
3 to 4	11	22	7·5 to 8·0	3	10·7
4 to 5	14	28	8·0 to 8·5	4	14·3
5 to 6	6	12	8·5 to 9·0	11	39·3
6 and over	1	2	9·0 and over	6	21·4
		100			100·0

There is still not much hope for any revision of the present law bearing on the retail sale of milk. Great changes have taken place in the supply of milk to the public due to the operation of the Milk Marketing Boards. I hope soon to issue a review of the present methods of supply, of the quality of milk, and of the necessity of legislation to meet modern conditions.

WATERS.

Of the samples analysed, six were found to be unfit for human use owing to the presence of sewage. One sample was found to contain zinc, probably due to the action of the water on galvanised iron piping. Another sample was found to contain a high proportion of bicarbonate of lime. Waters of this class are known as waters possessing temporary hardness, and can be rendered more satisfactory for domestic use by treatment. All the other samples were found to be of good quality.

POISONS.

As usual, quite a number of examinations of stomach contents and feeding-stuffs was made for the presence of poisons and substances deleterious or dangerous to the health of live stock. Arsenic was found to be the cause of death of two heifers and a number of lambs. An excess of salt in the crop was found to be the cause of death of poultry. Strychnine was found present in the stomach contents of a valuable sheep-dog. I have frequently pointed out that strychnine cannot be purchased unless prescribed in medicinal doses by a medical practitioner. I have learned, however, that, during the war, strychnine may be purchased by farmers for the destruction of moles on production of a certificate by an Agricultural Executive Committee, in amounts not exceeding four ounces on each individual certificate. The feeding-stuffs examined were found to be quite free from poisonous or injurious substances.

MISCELLANEOUS.

Interest is being taken throughout the country in the conservation of grass and hay. An article appeared in the 'Transactions' of the Society in 1935, explaining the Tripod system with air-vent constructors and giving an account of the feeding value of dried grass and Lucerne meal. It appears that any arrangement which will keep the material off the ground, allow air to pass through it freely and not expose it too much to the sun, is an improvement over the ordinary methods. It has been pointed out to me, however, that Proctor's Tripods do not eliminate the necessity for great skill and care in the making of hay. Under the same conditions a skilful haymaker will make better hay on the ground than an unskilled man on Proctor's Tripods. That, of course, is just common-sense. These Tripods, however, do allow the material to be put up in a greener state, and, with care, better hay can thus be made.

Among the miscellaneous samples analysed were samples of material from water-pipes, cheese curd, and sheep dip which had been submerged in salt water. With regard to the latter, I reported that nothing had happened to the dip to prevent it being used in the proportions prescribed by the Ministry of Agriculture.

SCOTTISH RED CROSS AGRICULTURE FUND.

SECOND ANNUAL REPORT.

REPORT ON ACTIVITIES OF THE COMMITTEE OF THE FUND DURING THE YEAR 17TH APRIL 1941 TO 16TH APRIL 1942, SUBMITTED TO, AND ADOPTED BY, THE GENERAL COMMITTEE AT A MEETING HELD ON 20TH MAY 1942.

ON 16th April the Committee of the Fund completed its second year of operations. The total amount of contributions received during the period was £109,717. To this was added a sum of £122, 6s. 10d., being interest accruing on sums placed on Deposit Receipt for short periods. This gave a total for the year of £109,839, 6s. 10d.

Adding this amount to the sum of £115,876, 14s. 2d., raised during the first year, gives a grand total of £225,716, 1s. raised by the Committee during its two years of activity.

As in the first year, the money raised during the second year was handed over to the Scottish Branch, British Red Cross Society, and the St Andrew's Ambulance Association, at various times throughout the year. The total allocated to the former body was £98,855, 8s. 1d., and to the latter £10,983, 18s. 9d.—in all £109,839, 6s. 10d. The allocation was made by the Allocation Committee, and was this year at the rate of 90 per cent to the Red Cross and 10 per cent to the St Andrew's. The proportion allocated to the former body was increased, as compared with last year, in view of the ever-growing commitments of the Red Cross through the extension of the War to new areas, the call for medical and surgical aid to our Allies, and the enormous demand for food parcels for prisoners of war.

The total allocation to the Scottish Branch, British Red Cross Society, during the past two years was, therefore, £191,316, 15s. 5d., and to the St Andrew's Ambulance Association, £34,399, 5s. 7d.—in all £225,716, 1s.

The expenses incurred in connection with the Fund during its second year amounted to a sum of £128, 4s. 9d., being mainly for postages, stationery, and printing. These expenses were again defrayed by the Highland and Agricultural Society, which also provided the staff, office accommodation, telephone service, &c., free of charge. The Committee was, therefore, able to hand over every penny it received, plus Deposit Receipt interest, to the benefiting Charities without any deduction whatever for expenses.

FREE GIFT SALES.

As was the case during the first year, it was found that Free Gift Sales were the most productive source of revenue. The majority of the Area Committees established during the first year continued to function during the second year. A few Committees, instead of a Free Gift Sale, adopted other means of raising money, such as voluntary levies, collections, &c.

Fifty-four Area Committees contributed during the past year, as compared with sixty-two in the preceding year. A gratifying feature was that in practically every case where Sales were held in 1941 these showed an increase in drawings compared with 1940, and in some cases a substantial increase. Unfortunately a number of Sales held in 1940 were not repeated in 1941, due mainly to the fact that the Committees at these centres, where large sums had been raised in 1940, felt that the effort could not be renewed until after an interval of two years. The falling off, however, was largely offset by Sales and Collections held at a number of new centres—notably in Aberdeenshire and Morayshire.

Several of the Committees which were unable to hold Sales in 1941 have already made plans for a renewed effort in 1942.

The following list is again arranged under Show Divisions, the date of the Free Gift Sale being given, and also, for reference, the amount raised in the preceding year.

Season 1940. *Season* 1941.

ABERDEEN SHOW DIVISION.

Free Gift Sales.

£1,241	*0*	*0*	Huntly (Strathbogie) . .	Oct. 16, 1941				£1,744	2	2
788	*19*	*2*	Alford . . .	„ 18, 1941				805	6	11
866	*4*	*2*	Stonehaven . .	„ 18, 1941				1,064	4	6
1,831	*3*	*11*	Ellon Area—	1941						
			Foveran .	Oct. 18	£608	15	1			
			Tarves .	„ 18	1,500	0	0			
			Hatton .	Nov. 1	1,025	3	1			
			Udny .	„ 1	1,267	11	6			
			Ellon .	„ 8	847	9	6			
								5,248	19	2
£4,727	*7*	*3*	Carry forward . .					£8,862	12	9

Season 1940.			*Season 1941.*
£4,727 7 3	Brought forward		£8,862 12 9
2,647 6 3	Aberdeen	Oct. 1941	2,159 14 8
5,020 0 0	Lower Banffshire (Banff and Cornhill)	Oct. 25-29, 1941	5,553 0 0
1,435 8 4	Insch	,, 30, 1941	1,264 10 1
2,046 0 0	Laurencekirk	Nov. 1, 1941	2,419 11 6
2,000 0 0	Inverurie	,, 8, 1941	2,150 0 0
..	Cluny (contribution from proceeds)	Dec. 6, 1941	1,000 0 0
332 14 3	Aboyne		..
548 5 8	Dufftown		..
338 12 1	Torphins		..
	Levies on Acreage, Collections, &c.		
1,506 10 0	Maud		2,500 0 0
1,400 0 0	Turriff (including balance of proceeds of 1940 Sale)		2,031 19 10
839 11 5	Keith		625 18 0
..	Methlick		500 0 0
522 18 0	Banchory		200 0 0
£23,364 13 3			£29,267 6 10

Border Show Division.

£555 7 0	Selkirk (Sunderland Hall)	Sept. 20, 1941	£587 6 5
182 16 2	Newcastleton	Oct. 14, 1941	177 15 0
2,600 0 0	St Boswells	,, 18, 1941	2,400 0 0
1,355 3 9	Peebles	,, 25, 1941	2,765 12 0
3,274 17 9	Kelso	Nov. 1, 1941	2,822 12 3
200 0 0	Hawick (contributions, &c.)		289 0 0
3,661 18 1	Duns		..
£11,830 2 9			£9,042 5 8

Dumfries Show Division.

£971 7 5	Thornhill (one-half proceeds)	Nov. 8, 1941	£1,117 19 11
590 6 2	Annan (do.)	Dec. 11, 1941	753 8 0
650 0 0	Dumfries (contribution from proceeds)	Jan. 17, 1942	600 0 0
219 0 0	Langholm (one-half proceeds)		..
4,000 5 3	Castle-Douglas (do.)		..
773 15 9	Lockerbie (do.)		..
£7,204 14 7			£2,471 7 11

Season 1940. *Season* 1941.

EDINBURGH SHOW DIVISION.

..			Bathgate	Mar. 15, 1941	£1,970	11	2
£3,109	*5*	*2*	Haddington	Oct. 24, 1941	2,780	10	8
2,100	*10*	*10*	Dalkeith	,, 25, 1941	2,449	0	5
1,709	*8*	*8*	Linlithgow	Nov. 15, 1941	1,704	12	2
1,692	*7*	*0*	Edinburgh		..		
£8,611	*11*	*8*			£8,904	14	5

GLASGOW SHOW DIVISION.

£4,009	*13*	*9*	Lanark	Oct. 30, 1941	£3,636	1	8
4,000	*0*	*0*	Ayr (South Ayrshire)—balance of proceeds of 1940 Sale		25	0	0
..			Tighnabruaich		114	10	0
550	*0*	*0*	Kilmarnock (North Ayrshire)		..		
1,357	*19*	*0*	Wishaw		..		
750	*0*	*0*	Strathaven		..		
2,017	*10*	*0*	Biggar		..		
£12,685	*2*	*9*			£3,775	11	8

INVERNESS SHOW DIVISION.

..			Elgin and Knockando	May 1, 1941	£1,889	0	6
..			Forres	July 30, 1941	1,616	9	2
£590	*5*	*6*	Inverness	Nov. 9, 1941	1,903	11	4
1,110	*0*	*0*	Dornoch	,, 29, 1941	1,060	0	0
1,211	*17*	*6*	Tain		..		
3,968	*14*	*6*	Dingwall		..		
£6,880	*17*	*6*			£6,469	1	0

PERTH SHOW DIVISION.

£2,007	*7*	*11*	Cupar	Aug. 16, 1941	£2,678	8	3
2,000	*0*	*0*	Thornton	,, 23, 1941	2,300	0	0
1,465	*0*	*0*	Anstruther (including balance of proceeds of 1940 Sale)	Sept. 27, 1941	1,627	2	0
2,127	*10*	*4*	Blairgowrie	Oct. 4, 1941	3,402	0	0
1,270	*0*	*4*	Milnathort	,, 4, 1941	1,550	0	0
1,770	*14*	*8*	Dunfermline	,, 11, 1941	2,056	8	7
620	*0*	*0*	Pitlochry	,, 11, 1941	696	16	4
4,801	*3*	*8*	Perth	,, 18, 1941	5,278	19	11
1,606	*3*	*7*	Aberfeldy		..		
£17,668	*0*	*6*			£19,589	15	1

STIRLING SHOW DIVISION.

Season 1940.					*Season* 1941.		
£2,031	*11*	*10*	Strathearn (Crieff and Auchterarder)—including balance of proceeds of 1940 Sale	Sept. 27, 1941	£2,014	8	9
2,373	*11*	*4*	Falkirk	Nov. 1, 1941	2,129	18	0
5,013	*0*	*0*	Stirling	„ 15, 1941	4,610	0	0
371	*10*	*0*	Drymen		..		
£9,789	*13*	*2*			£8,754	6	9

COUNTY OF ANGUS.

£3,500	*0*	*0*	Forfar	Oct. 18, 1941	£3,951	0	0
2,319	*18*	*4*	Montrose	„ 22, 1941	3,026	6	9
2,309	*7*	*0*	Arbroath	„ 25, 1941	2,763	7	3
2,003	*3*	*0*	Dundee	Nov. 1, 1941	2,488	2	0
1,600	*0*	*0*	Brechin	Dec. 13, 1941	3,437	3	5
£11,732	*8*	*4*			£15,665	19	5

ABSTRACT.

£23,364	*13*	*3*	Aberdeen Show Division	£29,267	6	10
11,830	*2*	*9*	Border „	9,042	5	8
7,204	*14*	*7*	Dumfries „	2,471	7	11
8,611	*11*	*8*	Edinburgh „	8,904	14	5
12,685	*2*	*9*	Glasgow „	3,775	11	8
6,880	*17*	*6*	Inverness „	6,469	1	0
17,668	*0*	*6*	Perth „	19,589	15	1
9,789	*13*	*2*	Stirling „	8,754	6	9
11,732	*8*	*4*	County of Angus	15,665	19	5
£109,767	*4*	*6*		£103,940	8	9

It will be seen that these sales, collections, and other efforts contributed a sum of £103,940, 8s. 9d. out of the final total of £109,839, 6s. 10d.

From the foregoing Abstract it will be noted that the Aberdeen Show Division (the Counties of Aberdeen, Banff, and Kincardine) heads the list with a total of £29,267. This is practically £6000 more than was raised in the same Division last year. Perth Show Division (Perthshire—Eastern District, Fife, and Kinross) comes next with a total of £19,589, being almost £2000 more than in the preceding year. It has to be noted that part of the County of Angus normally falls within the Aberdeen Division and part within the Perth Division. It was found, however, desirable to treat Angus as a separate unit, and that County alone raised the remarkable total of

£15,665 in 1941. This is almost £4000 more than it raised in the first year.

With regard to individual results, it is worthy of special mention that Lower Banff Area Committee again takes first place with a total of £5553, while Perth again takes second place with a total of £5278, 19s. 11d. A third Committee, that which was originally appointed for the Ellon and Udny areas, but which areas have now been regrouped and extended so as to include centres at Foveran, Tarves, and Hatton, has also topped the £5000 mark with a total of £5248, 19s. 2d. Other notable contributions were Stirling, £4610; Forfar, £3951; Lanark, £3636, 1s. 8d.; Brechin, £3437, 3s. 5d.; Blairgowrie, £3402; and Montrose, £3026, 6s. 9d. Special mention is made of these larger contributions, as the Committee of the Fund realises that such results could only have been attained through a magnificent effort on the part of the Area Committees concerned. The Committee is aware, however, that in many other areas striking results have been obtained through the splendid work of the Committees, at least three centres (Brechin, Inverness, and Peebles) having more than doubled their contributions, and several others having secured most remarkable increases.

VICTORY GARDEN SHOWS.

The new scheme for encouraging the holding of Victory Garden Shows and Sales met with gratifying success. Between forty and fifty of these Shows and Sales of Garden Produce were held during the months of August, September, and October 1941. In order to encourage Horticultural Societies and Allotment Associations to hold such Shows and Sales, the Committee offered them a supply of Advertising Posters, Exhibitors' Cards, Prize Labels, and Merit Certificates. Those Societies and Associations which decided to organise such functions entered into the scheme with great enthusiasm, and in most cases it is believed that the sums raised exceeded the amounts realised at the corresponding Shows held prior to the war. Other Societies which could not see their way to organise a Show sent donations to the Fund. The amount received as a result of these Victory Garden Shows and Sales totalled £1914, 16s. 1d.

The list is headed by Mauchline and District Show and Free Gift Sale, which contributed a sum of £173, 3s. 4d. Other notable contributions are from Kirkcaldy Joint Horticultural Show, £120, 8s. 4d.; Royal Caledonian Horticultural Society (one-half proceeds), £101, 5s.; and the Air Raid Wardens, Group B., Dumfries, £100. The latter achievement by a

Group of Air Raid Wardens is particularly worthy of mention. All the results, however, reflected the greatest credit on the Societies and Associations concerned, and their whole-hearted efforts have resulted in a most welcome addition to the Fund.

Much valuable advice and assistance regarding the organisation of these Victory Garden Shows was received from Mr Walter Brett, F.R.H.S., Chairman of the Victory Garden Show Committee of the Red Cross Agriculture Fund in England. Mr Brett's Committee organised Victory Garden Shows in England and Wales on an extensive scale, and he was at all times ready to give the Scottish Committee the benefit of his knowledge and wide experience.

FARM WORKERS' CONTRIBUTIONS.

The returns under the scheme for Penny-a-Week Contributions from Farm Workers were disappointing at the commencement, but in recent months there have been indications of a growing interest in the movement, and since November some gratifying sums have been received. The total received during the year amounted to £272, 9s. 1d. East Lothian heads the list with a total of £105, 1s. 9d., received through Mr D. S. Burnet, the Secretary of the Area Committee at Haddington. Other centres which have sent substantial contributions are Ayr, Dalkeith, Duns, Kelso, Udny, and St Boswells. It is hoped that as the scheme becomes more widely known the contributions from other centres will steadily increase. There is no doubt that in many districts this method of contribution was handicapped by the fact that local Red Cross Committees and other charitable organisations had already Penny-a-Week schemes in operation.

OTHER CONTRIBUTIONS.

Amongst Agricultural and Allied Bodies mention may be made of the Lockerbie and District Entire Horse Society which contributed a sum of £78, 11s., being the free proceeds of their 1941 Show. Strathaven and District Agricultural Exposition, which gave a donation of £40 in 1940, has generously contributed £50 during the year under review. The Perth Ram Society has given a third donation, and the Staff of the Edinburgh and East of Scotland College of Agriculture have continued to forward their much appreciated quarterly contributions to the Fund.

Various Whist Drives and Dances were held throughout the winter by Agricultural Organisations, and these resulted in a very welcome addition of £423, 16s. to the Fund. Of the latter, the largest sum received was £150 contributed by the Shettleston and Chryston Branch of the National Farmers' Union and Chamber of Agriculture of Scotland. Other notable efforts were those made by the Western District of Atholl Agricultural Association, £86, 5s., and Ardoch Agricultural Society, £50.

The Aberdeen and District Milk Marketing Board continued its scheme of monthly contributions by its milk producers, and the handsome sum of £419, 14s. 6d. was received in respect of the period December 1940 to December 1941. The continued support given by this Board, and by its producer members, is highly appreciated by the Committee.

A handsome donation of £500 was received from the County of Dumbarton War Benevolent Fund, being part of the proceeds of a Free Gift Sale organised by the Dumbartonshire Agricultural Society. It will be recalled that a sum of £250 was received from the same source in the preceding year. A sum of £250 was also received from the Lord-Lieutenant's War Schemes Fund of the County of Wigtown, this amount being similar to that received in 1940.

Young Farmers' Clubs have continued to give valuable support to the Fund, and a sum of £342, 19s. 2d. appears under this heading in the List of Contributions. The Inverness Junior Agricultural Club, which contributed £50 in the first year, increased its contribution to the splendid figure of £125 in the second year; Crossroads and District Young Farmers' Club, Ayrshire, which gave £55 in 1940, contributed £61 in 1941; the West of Fife Young Farmers' Club contributed £60, being practically the same amount as that given during the preceding year; and East Lothian Junior Agricultural Club sent a sum of £43, 15s. 2d. Other Clubs sent smaller, although equally welcome, donations. It is realised that, in addition to these generous and direct contributions, many Young Farmers' Clubs throughout the country have given valuable assistance to Area Committees in connection with their Free Gift Sales and other efforts.

Under Unclassified Contributions some generous donations are recorded. An anonymous gift by "A Berwickshire Farmer" added the handsome sum of £782, 0s. 4d. to the Fund. The paper 'The Racing Pigeon,' which has raised large sums for the English Committee, forwarded a sum of £176, 16s., being contributions by Scottish patrons of the sport. Mr James R. Barclay, Secretary of the Aberdeen-Angus Cattle Society, sent a cheque for £46, 14s. 4d., being a balance left in his hands after completing certain purchases of cattle on behalf of Mr and Mrs George K. Bailey, Wickwire Aberdeen-Angus Farm, Maryland, U.S.A. Seed Potatoes sold on behalf of the Fund by Mr Hugh M. Jackson, Cleughhead Farm, Lesmahagow, realised £38, 8s. 6d.; and the proceeds of live stock sold by the Crichton Royal Institution, Dumfries, in aid of the Fund, provided a further welcome contribution of £34, 13s. 9d. Messrs John Wallace & Sons, Ltd., Agricultural Implement Makers, Glasgow, remitted the sum of £18, 13s. 8d., being the proceeds of old records and waste paper sold. These and other smaller contributions produced a sum of £1140, 16s. 2d.—a splendid addition to the Fund. The receipt of these voluntary contributions gives much gratification to the Committee.

Throughout the List there are other interesting and notable contributions—evidence of the regard in which this good cause is held by the Agricultural community. Lack of space precludes individual mention, but to all those who have given, whether great sums or small, whether in united effort or individually, the Committee of the Fund is deeply grateful and tenders its heartfelt thanks.

LETTER FROM THE DUKE OF GLOUCESTER.

In December 1941 a letter was received from His Royal Highness The Duke of Gloucester, President of the Red Cross and St John Fund in England, in the following terms :—

DEAR MR STIRTON,—As President of the Red Cross and St John Fund in England, I am glad to learn of the splendid support which the Scottish Red Cross Agriculture Fund has given to the Scottish Branch of the British Red Cross Society and St Andrew's Ambulance Association. I feel sure that this could not have been achieved without the whole-hearted co-operation of all the Agricultural interests throughout Scotland, and I would ask you, as Secretary of the Scottish Red Cross Agriculture Committee, to convey to your Committee and to accept for yourself my congratulations and appreciation of the fine results of your efforts.

It is encouraging to know that the Agricultural communities in Scotland succeeded in raising over £130,000 for the Red Cross and St Andrew's Ambulance Association in the space of twelve months.—Yours truly, HENRY.

A facsimile copy of this gracious and encouraging letter was forwarded to each member of the Committee and to the Conveners and Secretaries of all Area Committees.

ACKNOWLEDGMENTS.

As the success of the Fund during its second year is again mainly due to the marvellous results of the Free Gift Sales held throughout the country, it is right that acknowledgment should first be made of the great work done by the Area

Committees in organising these Sales. That the Conveners, Members, Secretaries, and Treasurers of these Committees should have been willing to devote so much of their time and energy to these efforts for a second year is unmistakable proof of their great goodwill and genuine interest in the good work of the Red Cross. It is realised that many difficulties, not encountered to the same extent in the first year, such as shortage of staff, limited transport facilities, and intensified measures of control, had to be overcome. That these difficulties were surmounted with such striking success is ample testimony to the great enthusiasm and unsparing labour devoted to the cause by all concerned. For the magnificent work done by the Area Committees, and by their enthusiastic Conveners and efficient and hard-working Secretaries, the Committee of the Fund is very greatly indebted and most deeply grateful.

It naturally follows that reference should next be made to the splendid help so generously given to these Sales by the Live Stock Auctioneers. It is a simple statement of fact to say that, without their help and co-operation, the Free Gift Sales could not have been held. Whilst the Companies gave freely of their services, the services of their Staffs, and the use of their Marts, it is again worthy of mention that, in addition, many individual Auctioneers acted as Conveners or Secretaries of the Area Committees, and, in these capacities, did splendid work on behalf of the cause. The magnificent help given by the Live Stock Auctioneers is most highly valued and appreciated by the Committee, who fully realise the vital rôle of the Auctioneers and the essential importance of their goodwill and co-operation in attaining the success which the Fund has achieved.

Cordial thanks are again due for the help and co-operation extended to the Committee by the Directors and Members of the Highland and Agricultural Society, and by the Council, Members, and Officials of the National Farmers' Union and Chamber of Agriculture of Scotland. The representatives of these bodies, and of the County and District Agricultural Societies throughout the country, form the backbone of the Area Committees. The local branches of the N.F.U. and Chamber have, as mentioned in the last report, provided in many cases a ready-made basis for the Area Committees, and between them and the County and District Agricultural Societies have, in many instances, provided both Conveners and Secretaries for these Committees. To these bodies the Committee owes a debt of gratitude for the splendid work which has been achieved. Mention must also be made of the valuable help given by the Scottish Farm Servants' Union in introducing and encouraging the scheme of contributions by farm workers. It is believed that this scheme will develop and provide an increasing contribution to the Fund.

The response given by Horticultural Societies and Allotments Associations to the invitation to hold Victory Garden Shows in aid of the Fund was also highly appreciated by the Committee. Those Societies and Associations which decided to hold Shows entered into the effort with great energy and enthusiasm, and the results were most gratifying. The Committee believes that these Shows will be more numerous throughout the coming Season, and they are greatly indebted to all concerned.

Throughout the year most helpful publicity has been given to the Fund by the Scottish Press, both agricultural and daily newspapers having given prominence to news and items of interest regarding the progress of the Fund. For this valuable assistance the Committee owes a debt of gratitude to the newspapers concerned.

The Committee's relations with the Red Cross Agriculture Fund Committee in England have continued to be of the closest and most cordial nature. The efforts of that Committee, which include many lines of activity, have met with great success. Their organisation is comprehensive, and they have adopted many schemes for the raising of money for the Fund. Through the courtesy of the Chairman and Secretary of the Committee, particulars of these schemes are constantly made available to this Committee, so that their adoption may be tried out if found practicable. For this co-operation grateful thanks are due to that Committee, and especially to its Secretary, Mr Alec D. Robertson, who has continued with great courtesy and promptitude to respond to every request for help or advice from the Scottish Committee.

JOHN STIRTON,
Hon. Secretary and Treasurer.

8 Eglinton Crescent,
Edinburgh 12, *13th May* 1942.

For Abstract of Accounts, *see over.*

ABSTRACT OF RECEIPTS AND PAYMENTS BY THE HON. SECRETARY AND TREASURER FOR THE SECOND FINANCIAL YEAR, 17TH APRIL 1941 TO 16TH APRIL 1942.

1st Year—1940-41.	*Receipts.*		*2nd Year—1941-42.*
	1. Free Gift Sales, &c.—		
	(1) Proceeds of Sales—Season 1941—including Donations in Cash and other Receipts		£97,679 0 11
	(2) Proceeds of voluntary Levies, Collections, and other Receipts .		6,261 7 10
£109,767 4 6			£103,940 8 9
128 14 0	2. Victory Garden Shows—Proceeds of Shows and Sales held by Horticultural Societies, Donations, &c.—Season 1941		1,914 16 1
..	3. Penny-a-Week Scheme—Contributions from Farm Workers		272 9 1
	4. Agricultural and Allied Bodies—		
1,605 1 5	(1) Donations, &c. . .	£231 6 0	
118 11 0	(2) Proceeds of Whist Drives and Dances . .	423 16 0	655 2 0
3,366 12 0	5. Agricultural and Commercial Interests—Donations, &c.		700 8 9
500 0 0	6. Grants from County War Funds . .		750 0 0
213 9 9	7. Young Farmers' Clubs—Donations, &c.		342 19 2
53 10 5	8. Unclassified Contributions		1,140 16 2
58 6 3	Proceeds of Salvage		
£115,811 9 4			£109,717 0 0
65 4 10	9. Interest on sums placed on Deposit Receipt for short periods		122 6 10
£115,876 14 2			£109,839 6 10
	Payments.		
	1. Expenses of Administration—		
£25 0 0	(1) Postages		£33 0 0
	(2) Stationery, &c.—		
12 0 9	General	£14 17 6	
..	Victory Garden Shows	8 2 1	22 19 7
	(3) Printing, &c.—		
6 3 3	General	£10 3 1	
..	Victory Garden Shows	52 6 10	
..	Penny-a-Week Scheme	5 5 6	67 15 5
4 1 10	(4) Miscellaneous Payments . .		4 9 9
29 12 10	Travelling Expenses, &c. . .		..
£76 18 8			£128 4 9
76 18 8	Received from the Highland and Agricultural Society of Scotland to defray Expenses		128 4 9
..			..
	2. Payments to benefiting Charities—		
92,461 7 4	(1) Scottish Branch, British Red Cross Society	£98,855 8 1	
23,415 6 10	(2) St Andrew's Ambulance Association	10,983 18 9	
115,876 14 2			109,839 6 10
£115,876 14 2			£109,839 6 10

EDINBURGH, 12*th May* 1942.—I have examined the Books and Accounts of the Treasurer of THE SCOTTISH RED CROSS AGRICULTURE FUND COMMITTEE, of which the foregoing is an Abstract, and have found the same to be correctly stated, and sufficiently vouched and instructed.

GEO. JAMES GREGOR, C.A., *Hon. Auditor.*

THE CEREAL AND OTHER CROPS OF SCOTLAND FOR 1941.

THE following comparison of the cereal and other crops of 1941 with those of the previous year has been prepared by the Secretary of the Society from answers to queries sent to leading agriculturists in different parts of the country.

The queries issued by the Secretary were in the following terms:—

1. What was the quantity, per imperial acre, and quality of grain and straw as compared with last year, of the following crops? The quantity of each crop to be stated in bushels or cwts. What quantity of seed is generally sown per acre?—(1) Wheat, (2) Barley, (3) Oats.
2. Did the harvest begin at the usual time, or did it begin before or after the usual time? and if so, how long?
3. What was the quantity, per imperial acre, and quality of the hay crop, as compared with last year, both as regards ryegrass and clover respectively? The quantity to be stated in tons and cwts.
4. Was the meadow hay crop more or less productive than last year?
5. What was the yield of the potato crop, per imperial acre, as compared with last year? The quantity to be stated in tons and cwts. Was there any disease? and if so, to what extent, and when did it commence? Were any new varieties planted, and with what result?
6. What was the weight of the turnip crop, per imperial acre, and the quality, as compared with last year? The weight of the turnip crop to be stated in tons and cwts. How did the crop braird? Was more than one sowing required? and why?
7. Were the crops injured by insects? State the kinds of insects. Was the damage greater or less than usual?
8. Were the crops injured by weeds? State the kinds of weeds. Was the damage greater or less than usual?
9. Were the pastures during the season of average growth and quality with last year?
10. How did stock thrive on them?
11. Have cattle and sheep been free from disease?
12. What was the quality of the clip of wool, and was it over or under the average?

From the answers received, the following notes and statistics have been compiled :—

EDINBURGH DISTRICT.

MID-LOTHIAN. *Wheat*—50 bushels per acre. *Barley*—48 bushels per acre ; all very well secured. *Oats*—56 bushels per acre. *Harvest*—Began about the usual time, and under ideal weather conditions, both in early districts and the later ones. *Hay*—A good crop ; 40 cwt. per acre, and all well secured. *Meadow Hay*—Much the same as in 1940. *Potatoes*—A good crop ; 6 tons per acre on the good lands. *Turnips*—A very good crop ; 15 to 20 tons per acre. *Insects*—Little damage. *Weeds*—Caused less injury than usual, and weather perfect for working of land producing green crops. *Pastures*—Good, but much later than usual owing to cold spring. *Live Stock*—Did very well and were free from disease. *Clip of Wool*—Average and of good quality.

WEST LOTHIAN. *Wheat*—Autumn sown, 38 to 44 bushels per acre ; very little spring sown ; grain and straw of excellent quality ; seed sown, 3 to 3½ bushels per acre, drilled ; broadcast, 4 bushels per acre ; a few fields of wheat grown on good pasture, broken up, yielded from 64 to 80 bushels per acre. *Barley*—46 to 56 bushels per acre ; seed sown, 3 to 3½ bushels per acre, drilled ; grain and straw of excellent quality. *Oats*—56 to 72 bushels per acre ; seed sown, 4½ to 6 bushels per acre, according to variety ; grain and straw of excellent quality. *Harvest*—Began about ten days late, owing to the cold, wet spring ; but owing to the best of harvest weather in September, and ample assistance from the Military Authorities, a record acreage of grain was secured earlier than expected. *Hay*—45 to 55 cwt. per acre ; a good crop secured in good order. *Meadow Hay*—Very little grown. *Potatoes*—Earlies, 10 to 12 tons per acre ; lates, 8 to 10 tons per acre ; almost the same tonnage as last year, although planting on the whole was two weeks later ; very little disease ; no new varieties planted. *Turnips*—25 to 30 tons per acre ; a large crop all over as in the previous year ; brairded well ; no resowing required. *Insects*—Very little damage done ; less than usual. *Weeds*—Crops uninjured ; damage less than usual, except on a few fields of wheat and oats which were grown on ploughed-up grass-land, thistles being predominant. *Pastures*—Average growth and good quality. *Live Stock*—Throve well ; cattle and sheep were comparatively free from disease. *Clip of Wool*—Average quality and crop.

EAST LOTHIAN (Upper). *Wheat*—Rather less than last year ; 40 to 46 bushels per acre ; grain and straw harvested in good condition ; seed sown, 3½ to 4 bushels per acre. *Barley*—Similar to that of last year, 40 to 52 bushels per acre ; straw rather less ; harvested in good condition ; seed sown, 3 to 3½ bushels per acre. *Oats*—Similar to that of last year, 50 to 66 bushels per acre ; harvested in fair condition ; seed sown, 4 to 5½ bushels per acre ; marginal land at the hill-foots (cropped by order of the War Agricultural Executive Committee) gave smaller yield, 32 to 40 bushels per acre. *Harvest*—Started about a week later than last year ; quite a fair harvest, but dragged out owing in some cases to shortage of labour; soldiers in many cases did quite good service. *Hay*—Good crop secured in good condition; 45 to 55 cwt. per acre. *Meadow Hay*—Very little grown; similar in yield to previous years. *Potatoes*—Average crop; 8 to 9 tons per acre; on earlier farms lifted and stored in good condition; a long-drawn-out harvest, owing to shortage of labour; on later and outlying farms, 30 to 40 cwt. per acre wasted by frost; very little blight; leaf curl and other virus diseases similar to last year; very little sprain; no new varieties grown. *Turnips*—Quite a good crop, although not so heavy as last year; 14 to 20 tons per acre; fairly clear of finger-and-toe; some dry-rot; a good many more acres of mangolds and sugar beet grown; mangolds a very good crop; sugar beet about average. *Insects*—Very little damage; somewhat similar to last season. *Weeds*—Land tended to get dirtier owing to cross-cropping under war conditions and shortage of labour for cleaning green crops; thistles worse than for many years. *Pastures*—Came away rather later, but grazed well all season; growth, average. *Live Stock*—Above average; cattle and sheep grazed well, and were free from disease. *Clip of Wool*—Under average owing to very hard and stormy winter.

East Lothian (Lower). *Wheat*—Yield fairly good, but not so good as last year; average about 48 bushels per acre; straw about 2 tons per acre; crop secured in moderately good condition; seed sown, 3 to 4 bushels per acre. *Barley*—Slightly under average, 48 to 56 bushels per acre; quality fair; straw, 20 to 22 cwt. per acre; seed sown, 2½ to 3 bushels per acre on the best barley land. *Oats*—Average about 80 bushels per acre; quality good; straw, about 35 cwt. per acre. *Harvest*—About a fortnight later than normal owing to late seeding, adverse spring weather, and wet weather just before harvest. *Hay*—About 2½ tons per acre, mostly composed of Italian ryegrass with some red clover; no clover hay grown. *Meadow Hay*—None grown. *Potatoes*—Better than last year; about 10 tons per acre of Majestic and Great Scot, which predominate; although weather, rapid growth of haulms, and scarcity of labour prevented extensive spraying, disease was not very conspicuous at lifting time. *Turnips*—Yield quite good, about 22 to 25 tons per acre; brairding slow in many cases, but comparatively little second sowing; very considerable difficulty in getting the crop singled and hoed owing to great scarcity of casual labour. *Insects*—Comparatively insignificant damage; less than usual. *Weeds*—Crops very much injured, mostly by annual weeds; damage greater than usual. *Pastures*—Average, although late in coming on owing to cold, adverse weather, but they lasted well into the fall of the year. *Live Stock*—Did well, and cattle and sheep were free from disease. *Clip of Wool*—About average.

BORDER DISTRICT.

Berwickshire (Merse). *Wheat*—Was a full crop, 40 to 44 bushels per acre; natural weight, 62 lb. per bushel; straw, of medium length, 25 cwt. per acre; usual seeding, 4 bushels per acre. *Barley*—Mostly rather late in being sown; brairds were good, and prospects good, but much was laid, though cuttable one way; yields, fair average, 41 bushels per acre; natural weight, 55½ lb. per bushel; straw plentiful; 21 cwt. per acre, but not great in quality; seed sown, usually 2½ to 3 bushels per acre; at least one lot was sold at £20 per quarter. *Oats*—Much of the crop was sown late; brairds were thick; somewhat laid by harvest-time, but little twisted; 50 bushels per acre yields were quite common; grain plump, natural weight averaging 42 lb. per bushel; straw, 24 cwt. per acre, mostly of excellent quality; seed sown, generally 5½ bushels per acre for most varieties. *Harvest*—Should have been general by mid-August, but weather was very broken, and many out-fields got over-ripe; September, or most of it, was fine, and much of the crop was secured in good order despite shortage of hands; unfortunately October and early November was very broken, so the tail-end of the work was unduly protracted. *Hay*—A very bulky crop; 40 cwt. per acre or over; mostly reasonably well got; red clover was particularly strong. *Meadow Hay*—Better than last year, but was late and suffered some damage in August. *Potatoes*—An average crop of 6 tons per acre, with some up to 8 tons; lifting was made difficult through broken weather and shortage of hands; little or no disease and little spraying done; pits have kept well, except where the crop suffered from frost before lifting; no new varieties grown. *Turnips*—Swedes especially proved well above average, and still very plentiful; many fields yielded well over 30 tons per acre; average 26 tons per acre; yellows, 23 tons per acre. *Insects*—Turnip midge did some damage; finger-and-toe prevalent in certain areas. *Weeds*—Shortage of labour had its effect in an increase of annual weeds amongst cereal crops; thistles were very prevalent where grass that had lain some time had been cropped. *Pastures*—Average growth and quality; got very bare in June, but came away again, though there was never much roughness and none at all for autumn. *Live Stock*—Experienced a normal grazing season, and cattle and sheep were free from disease. *Clip of Wool*—Average quality, but light.

BERWICKSHIRE (Lammermoor). *Wheat*—Again a much larger area was seeded than before the war; due to the extremely hard winter, only the early sown fields were successful; in many cases the crop was thin and very dirty with thistles and other weeds; yield when crop reasonably successful, about 36 to 40 bushels per acre; quality of grain not so good as last year; seed sown, 3 to 3½ bushels per acre. *Barley*—Again a fairly large area sown; due to bad weather conditions during harvest time, quality not so good as last year; yield, about 40 bushels per acre; seed sown, 3 to 3½ bushels per acre. *Oats*—A large increase in acreage sown; crop on the whole not so successful as last year; many good yields were secured, but also thin and badly harvested crops from poor land; yields, 32 bushels to 64 bushels per acre; seed sown, 4 to 6 bushels per acre. *Harvest*—Fully a week later than last year, and fairly protracted, though the weather conditions were not nearly so bad as sometimes; shortage of labour added to large increase in extent of crop, resulted in considerable quantity of spoiled grain. *Hay*—A good crop and in most cases well secured; yield, fully 1½ tons per acre, where not grazed. *Meadow Hay*—An average crop, secured in fairly good condition. *Potatoes*—A fairly good crop, secured with considerable difficulty; on the average not so good as last year, about 7 tons per acre; disease not troublesome; no new varieties of any note. *Turnips*—A very good crop throughout the whole district; yield fully better than last year; crop brairded well; practically no reseeding necessary. *Insects*—Very little trouble noticeable. *Weeds*—Rather more troublesome than last year; many fields carrying a second white crop badly infested with thistles; shortage of labour encouraged annual weeds in turnip crops. *Pastures*—Were of full bite during the whole season, and the quality of the grass seemed better than last year. *Live Stock*—All classes throve well; both cattle and sheep were free from disease; the plough-up of land and the reduction in sheep stocks seem to have resulted in healthier stock. *Clip of Wool*—Full average of good quality.

ROXBURGHSHIRE. *Wheat*—On the whole very variable, some very bad, others big and bulky; good crops, yield 10 to 12 bushels per acre down on last year; seed sown, 3½ to 4 bushels per acre. *Barley*—On good land slightly under the previous year's bulk, from 4 to 5 bushels per acre less; on poorer fields the yield was very disappointing; straw generally of good quality; seed sown, 2½ to 3½ bushels per acre. *Oats*—On good land properly cultivated yield almost similar to last year, or about 65 to 75 bushels per acre; secondary quality land, from 40 bushels per acre upwards; there were many very poor crops on marginal land; straw on the whole of good quality. *Harvest*—Crops were a little later than last year in ripening, but a commencement was made a few days earlier than usual; a spell of bad winning weather made the handling of the crops very difficult. *Hay*—Difficult winning weather made many crops only secondary in quality; early saved crops bulked well, especially where they were top-dressed. *Meadow Hay*—Rather more productive, but quality not so good. *Potatoes*—Big yields were common, and disease was not very much in evidence. *Turnips*—A good braird and continuous and steady growth, particularly in the late autumn; all over, nearly a record for bulk; resowing was very seldom required. *Insects*—Very few complaints of damage. *Weeds*—About average, except where a definite shortage of labour let them get out of hand. *Pastures*—Abundance of grass all the season, and with good weather they lasted well on to the end of the year. *Live Stock*—Did well and put on weight; cattle were practically free from disease, as also were sheep, except that very serious loss occurred amongst lambs during September and October, which so far has not been explained. *Clip of Wool*—Neither quality nor quantity up to average.

SELKIRKSHIRE. *Wheat*—Very little grown. *Barley*—A small quantity grown, and crops rather poor; 30 to 35 bushels per acre. *Oats*—In spite of the long frost, sowing was completed by the end of April; brairded quite well and finished an average crop, except on old grass-land newly ploughed up, which suffered from the drought in June; 35 to 45 bushels per acre on good, and 20 to 30 bushels on poorer land; seed sown, 5 to 6 bushels per acre. *Harvest*—Began ten days later than usual, and owing to broken weather lasted for seven to eight weeks. *Hay*—Ryegrass hay was an average crop, secured in fairly good order. *Meadow Hay*—An average crop, but damaged by weather. *Potatoes*—On the whole the crop was poor;

7 to 8 tons per acre; very little disease. *Turnips*—Brairded well and finished a good crop, with less finger-and-toe disease than usual; 15 to 20 tons per acre; no resowing. *Insects*—No serious damage caused. *Weeds*—Difficult to keep in check on account of labour shortage. *Pastures*—Good all season and lasted well into the autumn. *Live Stock*—Did well and were free from disease. *Clip of Wool*—Under average.

PEEBLESSHIRE. *Wheat*—A very much larger acreage grown than usual; a good crop which ripened well; 40 to 48 bushels per acre. *Barley*—Large increase; some fields very badly lodged; average, 36 to 48 bushels, and in exceptional cases up to 60 bushels per acre; on the whole a very good sample. *Oats*—Large increase in acreage; many fields very badly laid; good land produced excellent crops of 56 to 64 bushels per acre, but on the poorer and higher land some fields were most disappointing, 24 to 40 bushels per acre according to districts. *Harvest*—Began at the usual time; early districts had a good harvest, but in late districts, after the weather broke, harvesting was impossible, and in some cases crops were never cut. *Hay*—35 to 40 cwt. per acre; quality good where early cut, but the later crops were badly damaged by weather conditions. *Meadow Hay*—Good average crop. *Potatoes*—From 7 to 8 tons, dressed ware, per acre; more disease than usual. *Turnips*—A good average crop, and, with a good growing autumn, improved immensely and were very free from disease. *Insects*—Some of the old lea fields which were broken up suffered from wireworm; wood-pigeons caused much damage to clover seeds and young turnips. *Weeds*—Thistles have been plentiful. *Pastures*—In some parts exceedingly bare; extra ploughing-up caused stock to be grazed more thickly than usual per acre. *Live Stock*—Summered quite well; cattle and sheep were fairly healthy, but grass sickness amongst horses was very bad on some farms. *Clip of Wool*—Park sheep clipped quite well; hill sheep, especially on hard hills, were much below average.

DUMFRIES DISTRICT.

DUMFRIES (Annandale). *Wheat*—A much larger acreage grown; mostly an excellent crop, well harvested and threshed; yield much the same as last year, about 30 cwt. per acre; straw, 30 cwt. per acre. *Barley*—A larger acreage grown, and a better crop than the previous year; threshed 35 bushels per acre; straw, 20 cwt. per acre. *Oats*—A larger acreage grown, and rather a better crop than last year, and threshed well; yield, 32 bushels per acre on high ground, and about 48 bushels on the better land; straw, 15 cwt. and 20 cwt. per acre. *Harvest*—Began about third week of August; crops rather more difficult to cut than last year, and weather rather broken to begin with; the first cut grain not so good in colour as usual, but leading-in was carried out in good weather; harvest lasted about six weeks on the earlier, and five weeks on the later farms. *Hay*—Crop one of the best for several years, well secured; about 38 cwt. per acre on good land, and rather less on lighter soils. *Meadow Hay*—Was also better than last year, and well secured; 35 cwt. per acre.

Potatoes—A good crop similar to last year; free from disease; about 9 tons per acre; weather very wet at raising time and labour scarce, but they seemed to keep quite well in pit; the usual varieties grown. *Turnips*—Average crop, about 19 tons per acre; quality not so good as last year, but seemed to keep well; brairded well, and very little resowing was done. *Insects*—No more than usual injury. *Weeds*—Crops not damaged to any great extent, but shortage of labour made it more difficult to keep land clean. *Pastures*—Very good all season, and were more heavily stocked than usual owing to extra ploughing-up of pasture-land. *Live Stock*—Did very well; cattle and sheep were free from disease. *Clip of Wool*—Good, and about average.

DUMFRIES (Nithsdale). *Wheat*—None grown. *Barley*—None grown. *Oats*—A very good crop; some fields laid. *Harvest*—About a fortnight later than usual; on high-lying farms cutting was done during the first part of October, or a month late, but the crop was well got, helped by windy and mostly dry weather. *Hay*—A good crop and well got, but stacking was slow. *Meadow Hay*—About the same as in the previous year; some well got, and some badly weathered. *Potatoes*—A poor crop, about one-third less than last year; about 5 tons per acre; some disease noticeable at lifting time. *Turnips*—A fairly good return, but not up to last year's bumper crop; 16 to 22 tons per acre; brairded well; a few cases of resowing. *Insects*—Crops free from damage; pigeons still destructive. *Weeds*—Fairly plentiful owing to wet summer, especially in August and September. *Pastures*—About the same as last year; lasted well into second week of October. *Live Stock*—Did as well as last year, but the feeding value did not seem to be in the September grass; cattle and sheep were fairly free from disease; trembling, or tick-borne fever, bad in lambs. *Clip of Wool*—Average quality, but much lighter, owing to bad spring.

DUMFRIES (Eskdale). *Wheat*—None grown. *Barley*—Very little grown. *Oats*—Mostly much lighter than last year, owing to very dry weather in May and June; straw shorter; yield, 34 to 40 bushels per acre; seed sown, 5 bushels for smaller, and 6 bushels for larger oats per acre. *Harvest*—Commenced about the usual time. *Hay*—Ryegrass lighter than last year owing to dry weather, and was mostly got in good condition. *Meadow Hay*—Much lighter than last year, mostly got in good condition, excepting in very late places where there was bad weather. *Potatoes*—Slightly better crop than last year's, and there was very little disease; no new varieties planted. *Turnips*—Very varied; in the lower districts very good, but in some of the higher, disappointing, with many rotten, probably owing to the long dry spell in summer. *Insects*—No damage caused. *Weeds*—Very little injury; weather at hoeing time excellent for destruction. *Pastures*—Not of average growth in early part of season owing to dry weather, but came away well after rain and grazed well all autumn. *Live Stock*—Throve well on pastures, especially in latter part of season; cattle and sheep have been very free from disease. *Clip of Wool*—Quality about an average, but the weight very disappointing and very much short of last year's, sheep having been so poor in condition during the spring.

KIRKCUDBRIGHTSHIRE. *Wheat*—Acreage, though comparatively small, was the largest for many years; where grown on suitable land the yield was good. *Barley*—This crop was grown on quite a few farms, and although in some cases it got rather badly weathered the financial return was excellent. *Oats*—Best crop for many years; yields of 50 to 60 bushels per acre quite common on the average farm; on secondary and marginal land, however, owing to late ploughing and a late season, crops were very poor. *Harvest*—Started first week of August, but not general until the middle of the month; rain fell in August, but September was good, and most crops were stacked in good order; owing to a very wet spell in October a good deal of grain was wasted in stacks before they were thatched. *Hay*—Rye-grass quite an average crop, 30 to 35 cwt. per acre. *Meadow Hay*—Also average, 30 cwt. per acre; most hay was secured in good order, but through lack of sunshine not the fine hay of 1940. *Potatoes*—Quite good, hardly as bulky as 1940; 7 tons per acre. *Turnips*—Quite an average crop, but with the much wetter season there was too much shaw, and weeds were very prevalent; yield, about 18 tons per acre. *Insects*—No special trouble occurred. *Weeds*—Owing to the wet season, weeds were very prevalent, especially in green crop fields. *Pastures*—Except for the months of May and June, grass was very scarce; pastures right on to New Year were excellent. *Live Stock*—With the exception of the first six weeks of the grazing season, stock did remarkably well, especially in the late autumn; cattle and sheep were comparatively free from disease, but there were quite a few cases of grass sickness in horses. *Clip of Wool*—Again slightly under the average as a result of the hard winter.

WIGTOWNSHIRE. *Wheat*—Very little grown. *Barley*—Very little grown. *Oats*—Lea oats, 36 to 38 bushels per acre; after green crop, 40 to 42 bushels per acre; seed sown, potato oats, 5 to 6 bushels per acre broadcast, 3 to 4 bushels per acre drilled; large varieties, 5 to 7 bushels per acre; dry weather in May and June checked progress, but after rain straw was plentiful, and grain filled out before harvest. *Harvest*—Later of starting except on very early farms; about the end of September the weather broke down and crops could only be got in with difficulty. *Hay*—Owing to dry weather in May and June the crop was rather light, about 2 tons per acre; early got hay was excellent, but later not so good; aftermath better than the previous year. *Meadow Hay*—About the same as the previous year. *Potatoes*—Early potatoes did quite well; owing to the difficulty of obtaining labour, digging was retarded; 8 to 9 tons per acre; late potatoes did not do nearly so well as last year; 6 to 8 tons per acre. *Turnips*—18 to 20 tons per acre; brairded well; owing to frost, resowing was necessary on some farms; crop generally good and fairly free from disease. *Insects* — Damage seemed to be much less than usual. *Weeds*—Dockens showed no signs of decreasing and redshank was prevalent in turnip fields; thistles were more numerous than usual. *Pastures*—Were about average or rather more than average, and grass lasted out fairly well. *Live Stock*—The season 1941 was better than 1940 for dairy cows, although their acreage of grass is steadily being reduced by additional land being ploughed up; young stock throve very well; grass sickness still took its toll of horses; some cases of navel-ill and hoven as usual; some stomach trouble in young calves; sheep freer from disease than for some time. *Clip of Wool*—Above the average in quantity and quality.

GLASGOW DISTRICT.

AYRSHIRE. *Wheat*—Grain, 40 bushels per acre; straw, 20 cwt. per acre; owing to moist weather at harvest the grain was soft and not marketable till it had been in the stack for two or three months; seed sown, 3 bushels per acre. *Barley*—Very little grown. *Oats*—48 bushels per acre; straw, 20 cwt. per acre; a big lot of oats in the later districts suffered from weather at harvest, and considerable waste took place in the stacks; straw plentiful, but much of it poor quality; seed sown, 4½ to 6 bushels per acre. *Harvest*—Began about the usual time, but made poor progress for the first two weeks; good progress was made for the next fortnight, but later lots suffered considerably from wet weather. *Hay*—Averaged about 30 cwt. per acre, secured in reasonable condition, but not so good as last year; much was kept in the field rick too long owing to wet weather; clover was plentiful in most cases. *Meadow Hay*—Was not such a good crop as last year owing to the late spring and lack of early growth. *Potatoes*—The early crop was much later than usual, and on sandy land was small, about 3 to 5 tons per acre; on earthy land return was about average, but not so good as last year; 8 to 10 tons per acre; blight became prevalent about the middle of July and seriously reduced the yield of late varieties. *Turnips*—A good crop, being about 20 tons per acre, but not so good as last year; slow to braird owing to cold weather, and did not make much progress until after singling time. *Insects*—No unusual damage caused. *Weeds*—Were kept fairly well under control. *Pastures*—Very late in growing in the spring, and were grazed bare until well into summer; about August pasture became plentiful, and remained fresh late in the year, but was well eaten down. *Live Stock*—Did not make maximum progress on grass owing to cold and scarcity; cattle and sheep have been reasonably free from disease largely due to the preventative measures now taken. *Clip of Wool*—Quality of the wool was under average.

ARRAN. *Wheat*—None grown. *Barley*—None grown. *Oats*—Excellent crop, secured in very good order; 18 to 20 cwt. per acre; straw, 15 to 18 cwt. per acre; seed sown, 1½ cwt. per acre. *Harvest*—Commenced on 5th August, and except for some late-sown oats harvest was finished by middle of September, being two weeks earlier than previous year. *Hay*—Crop in general was good, yielding 35 to 45 cwt. per acre, a little under previous year's. *Meadow Hay*—Very little grown, and badly wasted by weather. *Potatoes*—Bulked well; 7 to 8 tons per acre; blight was late in having a detrimental effect on crop. *Turnips*—Crop good where grown on lea with slag and bone meal as manures, and sal ammonia as a dressing when thinned; raan again appeared in some districts, having a bad effect. *Insects*—No serious damage caused; pigeons did most damage. *Weeds*—Not harmful where properly handled in dry weather. *Pastures*—Good where they received a top-dressing in spring, but too little attention was paid to this. *Live Stock*—Did well and were in great demand at local sales; no disease has been reported among stock. *Clip of Wool*—Up to usual quality.

LANARKSHIRE (Upper Ward). *Wheat*—Only small quantities grown. *Barley*—None grown. *Oats*—45 to 70 bushels per acre; grain and straw of good quality; seed sown, 5 to 6 bushels per acre. *Harvest*—Commenced 3rd September; weather quite good. *Hay*—1½ to 3½ tons per acre, a better crop than previous year; well secured. *Meadow Hay*—A good crop, well secured. *Potatoes*—A fair crop, much less than last year; 6 to 8 tons per acre; lifting weather rather wet for pitting in best condition. *Turnips*—A good crop; slightly less than last year; 15 to 25 tons per acre. *Insects*—Very little damage reported. *Weeds*—More damage than last year; more difficult to control owing to wet weather. *Pastures*—Good. *Live Stock*—Throve well; free from disease. *Clip of Wool*—Under average.

LANARKSHIRE (Middle and Lower Wards). *Wheat*—Yield, 25 cwt. per acre; straw, 30 cwt. per acre; generally the crop was well secured, but threshed grain not in good condition; seed sown, English 3 bushels, Scotch 4 bushels, per acre. *Barley*—None grown. *Oats*—Similar to last year; grain badly laid in certain districts; yield, from 30 to 35 cwt. per acre; straw, 30 cwt. per acre; samples of both grain and straw variable; early districts not first quality; later districts well got and of good quality. *Harvest*—Commenced in the earlier districts in the second week of August, and in the later districts in the first week of September. *Hay*—Crop well secured and heavier than last year; yield, 40 to 50 cwt. per acre. *Meadow Hay*—Yield was greater than, and quality equal to, last year's crop, which was particularly good. *Potatoes*—Yield less per acre than last season, the tubers not being large; since pitting disease has developed in certain varieties the tonnage per acre of marketable potatoes will be very much reduced; yield on average, 7 to 8 tons per acre; no new varieties planted. *Turnips*—Yield similar to last year, 30 tons per acre; brairded well and no second sowings required; finger-and-toe and dry-rot developed in certain fields throughout the district. *Insects*—No injury to crops recorded. *Weeds*—Owing to shortage of labour the green crop generally suffered from annual weeds. *Pastures*—On the heavier soils pastures grazed well throughout the season, but on lighter land the flush of grass had gone by the end of July. *Live Stock*—Where pasture was good, cattle and sheep did reasonably well, but where heavily stocked, young stock returned in poor condition; many lambs formerly disposed of in the Fat Market had to be sold as stores; both cattle and sheep remained free from disease, but there were quite a number of casualties amongst cattle at the commencement of the grazing season where excessive quantities of artificial manure had been applied. *Clip of Wool*—Owing to the severe winter was not up to the average, and this applied particularly to regular black-faced sheep stocks.

RENFREWSHIRE. *Wheat*—Rather under average; on heavier lands 20 to 30 cwt., and on lighter lands 18 to 25 cwt., per acre; straw, 20 to 30 cwt. per acre; seed sown, 3 to 4 bushels per acre. *Barley*—None grown. *Oats*—Average crop; grain, from 20 to 30 cwt. per acre; straw, 25 to 30 cwt. per acre. *Harvest*—Began about 14th August, a week later than previous year, and finished about third week in September; crop mostly secured in good order, except in later districts. *Hay*—An average crop; 2 to 3 tons per acre; secured in fair order only; weather rather broken. *Meadow Hay*—Little grown, and rather spoiled by weather. *Potatoes*—An average crop; 9 to 11 tons per acre of second earlies (British Queen) and main crop (Kerr's Pink); free of disease when dug early, but disease reported in pits later; no new varieties reported. *Turnips*—An average crop; 20 to 30 tons per acre; brairded well and came early to the hoe; no resowing reported. *Insects*—No damage noted, except wireworm in old pastures; crows did more damage than wireworms, as they (the crows) pulled out potatoes to get at the insects, necessitating replanting in some instances. *Weeds*—Injury no worse than previous years, but labour very scarce to combat them. *Pastures*—Did well and grazed right on to December. *Live Stock*—Throve well, but few cattle finished on the grass owing to scarcity of artificial feeding-stuffs; no outbreak of disease reported. *Clip of Wool*—Average for quantity and quality.

ARGYLLSHIRE (Lochgilphead). *Wheat*—Practically none grown. *Barley*—Practically none grown. *Oats*—Much the same as last year; grain, 25 to 30 bushels per acre; straw, about 20 cwt. per acre; seed sown, 5 to 6 bushels per acre; crops ripening late suffered a good deal from the weather before being secured. *Harvest*—Began about the usual time. *Hay*—A very fair crop, but not up to last year; about 25 cwt. per acre; weather was not favourable for hay-making, and quality suffered. *Meadow Hay*—Much the same as last year. *Potatoes*—Not so good as last year; possibly the crop suffered from lack of sunshine and warmth; average, 4 or 5 tons per acre; no reports of disease, and no extensive planting of new varieties. *Turnips*—Much the same as last year; 20 to 25 tons per acre; dry, cold weather in May retarded brairding; not much resowing, and the crop grew well after starting. *Insects*—Not much injury noted. *Weeds*—No great damage observed. *Pastures*—Very late in coming away, but lasted out well in the back-end. *Live Stock*—Did very well; cattle and sheep were free from disease on the whole; there were some cases of redwater in cattle. *Clip of Wool*—Average.

ARGYLLSHIRE (Kintyre). *Wheat*—Acreage grown similar to that of 1940; yield of grain lower than previous year; seed sown, 3½ bushels per acre. *Barley*—Acreage grown showed increase of approximately 50 per cent over 1940; crop good, but difficult to harvest on some farms due to bad weather just before harvest; yield of grain good, 20 to 22 cwt. per acre; seed sown, 3½ to 4 bushels per acre. *Oats*—Larger acreage grown than in 1940; crop mostly procured in good condition; harvesting somewhat difficult owing to weather conditions; many instances of crop lodging; straw of early crop badly broken where cutting was delayed; average yield of grain about 18 cwt. per acre, rising to 25 cwt. on better land; good bulk of straw; seed sown, 5 bushels per acre. *Harvest*—Commenced second week in August; rather protracted owing to broken weather. *Hay*—Yields fairly good considering slowness of growth in early part of season; crop secured in excellent order; average about 32 cwt. per acre; acreage of western wolth greatly reduced, seed being unobtainable. *Meadow Hay*—Crop rather lighter than usual. *Potatoes*—Yield of earlies, 5½ tons per acre for earlier liftings; main crop rather lighter than previous year, due to poorer growing season, averaging 6 to 7 tons per acre; crop healthy and no reports of serious disease; Epicure and Kerr's Pink main varieties. *Turnips*—Good average crop yielding 20 to 25 tons per acre; came away well after sowing; crop generally healthy and kept well; dry-rot not so prevalent; a few cases of raan recorded. *Insects*—Very little damage reported. *Weeds*—Fairly good season for cleaning root crops; charlock prevalent in some districts; docks and ragwort very prevalent in pasture-land. *Pastures*—Growth rather late in commencing; autumn growth fairly plentiful, providing useful keep in back-end. *Live Stock*—Pastured well after growth commenced; stocks well maintained despite greater acreage under the plough; abundant growth in autumn carried stock into the winter period in good condition; cattle and sheep generally fairly healthy; sheep stocks suffered heavily from the weather experienced in the early months of the year, and following the severe spring of 1940 ewe stocks were in very poor condition; the lamb crop in certain districts was greatly reduced in consequence; the open weather experienced during autumn and early winter enabled ewes to improve in condition, and should do much to ensure more satisfactory returns for 1942. *Clip of Wool*—Similar to previous year, quality below average.

ARGYLLSHIRE (Islands of Islay, Jura, and Colonsay). *Wheat*—None grown. *Barley*—A few acres, grown experimentally, made quite a good crop. *Oats*—Promised an unusually good crop, but prolonged wet weather made harvesting difficult, and yield averaged 41 bushels per acre, weight 41 lb. per bushel; straw showed an improvement on 1940; seed sown, 5 to 6 bushels per acre. *Harvest*—Began about 20th August and lasted until the end of October; heavy rain in August and September laid crops badly, and made harvest both late and difficult. *Hay*—Much the same as last year, but perhaps a little lighter, giving about 21 cwt. per acre for ryegrass, and 31 cwt. per acre for clover. *Meadow Hay*—This was also a shade lighter, but an improvement on 1939. *Potatoes*—Another good year, and yield again about 8½ tons per acre; ripened well and kept free from damage by blight or insects; a few good days in October allowed lifting in good order, and there was no breakaway from the usual varieties. *Turnips*—Were also a good crop, yielding 16½ to 17 tons per acre; brairded well and benefited from the wet autumn, making growth to the end of November. *Insects*—Crops again escaped undue damage, and 1941 may be regarded as a good year so far as they are concerned. *Weeds*—Less troublesome than usual; redshank presented no undue difficulty and damage was on the whole slight. *Pastures*—Were late in growing owing to dry, cold spring, but came away well in July and were similar to last year and an improvement on the preceding year. *Live Stock*—Sheep suffered from lack of growth in spring, and cattle were later than usual in going out, but made a good recovery in summer months; cattle and sheep kept free from disease, and although maggots gave some severe trouble for a few weeks, the period was not unduly extended. *Clip of Wool*—Quality and quantity average.

STIRLING DISTRICT.

DUMBARTONSHIRE (Upper). *Wheat*—Very little sown; difficulty in seeding due to wet weather; hard winter thinned out braird; harvested in fair condition; yield, about 30 bushels per acre; straw, 25 cwt. per acre; seed sown, 3 to 4 bushels per acre. *Barley*—None grown. *Oats*—Good crop; about 35 to 45 bushels per acre; straw, 25 cwt. per acre; seed sown, 4 to 5 bushels per acre. *Harvest*—Began about the usual time, but was held up by showery weather for a fortnight, resulting in discoloured grain; later cutting was well saved. *Hay*—Ryegrass, lighter crop than usual, with poor aftermath generally; 30 cwt. per acre. *Meadow Hay*—Secured in fair quality; reasonable crop. *Potatoes*—Looked very promising, but Kerr's Pink was very disappointing, about 2½ to 3 tons per acre less than last year at 7½ tons per acre; Golden Wonders did well at 8 tons per acre; no new varieties grown. *Turnips*—Brairded very well, and looked well throughout the season, but lifted only moderately; about 18 to 20 tons per acre; there was no resowing. *Insects*—Very little damage done, except to turnips, which were very extensively damaged by the maggot, reducing the yield considerably and affecting the keeping quality. *Weeds*—Usual annuals difficult to control, due to shortage of labour and weather conditions. *Pastures*—Grazed very well throughout the season, and, helped by mild weather in the back-end, lasted longer. *Live Stock*—Did very well on the grass; no diseases reported except very prevalent udder-clap in back-calving cows and heifers. *Clip of Wool*—Much about the average.

DUMBARTONSHIRE (Lower). *Wheat*—Crop not equal to that of 1940 either in quantity or quality; 40 bushels per acre; straw, 23 cwt. per acre; seed sown, 3½ bushels per acre. *Barley*—Very little grown. *Oats*—A good bulky crop, especially in the later districts, yielding about 47 bushels per acre; straw, 23 cwt. per acre; quality, good; seed sown, 5½ bushels per acre. *Harvest*—Commenced about a week later than usual, and was long drawn out. *Hay*—Ryegrass and clover a very good crop; about 35 cwt. per acre; quality suffered a little from broken weather. *Meadow Hay*—Was also bulky; quality, medium; yield, 34 cwt. per acre. *Potatoes*—Not so heavy a crop as in 1940 by at least 1 ton per acre, being rather under 7 tons per acre; disease struck down the haulms about the end of August; no new varieties planted. *Turnips*—A sound average crop, although not so bulky as in 1940, about 17 tons per acre; brairding was very regular and no resowing required. *Insects*—No appreciable damage done. *Weeds*—Shortage of labour was accountable for any little increase in the menace of annual weeds in the green crops. *Pastures*—Rather bare during the beginning of the grazing season, but during the autumn mild, moist weather flushed the grass considerably and extended the grazing season. *Live Stock*—Grazing animals made good progress, but the lack of concentrates as an extra made the fattening finish slower; maggots were troublesome among sheep stocks towards the end of August, while mastitis was more prevalent than usual among back-calving cows. *Clip of Wool*—Very much under the average, probably because of the severity of previous winter.

STIRLINGSHIRE (West). *Wheat*—Not much grown; better result than last year; yield, about 23 cwt. per acre; quality very good; seed sown, 4 bushels per acre. *Barley*—None grown, except a very few small parcels. *Oats*—Average yield down; 20 cwt. per acre; quality excellent; seed sown, 5 bushels per acre. *Harvest*—Began about usual date. *Hay*—Quality excellent over all; quantity average. *Meadow Hay*—Average crop. *Potatoes*—Average about 9 tons per acre; very little disease; no new varieties reported. *Turnips*—Average yield, 20 to 25 tons per acre; good braird; no resowing; good quality. *Insects*—No damage to record. *Weeds*—Absent in white crops and in turnips until July, when redshank appeared more heavily than last year. *Pastures*—Backward at start, but improved to good pasture later. *Live Stock*—Throve very well; cattle and sheep were fairly free from disease, but udder troubles in cows still prevalent, probably more so than last year. *Clip of Wool*—Quality good; quantity average.

CLACKMANNANSHIRE. *Wheat*—The braird was good, and the crop very good; 40 to 45 bushels per acre; straw, 30 to 35 cwt. per acre; seed sown, 4 bushels per acre. *Barley*—A good crop, 40 to 48 bushels per acre; seed sown, 3 to 4 bushels per acre; straw, 30 to 35 cwt. per acre. *Oats*—A very big crop badly laid in many places and very difficult to cut; yield, 45 to 48 bushels per acre; weight 40 to 42 lb. per bushel. *Harvest*—Began about the usual time, except where the corn had been sown late and in these cases the harvest was late and difficult. *Hay*—A good crop, 40 to 45 cwt. per acre; quality very good. *Meadow Hay*—Very little grown. *Potatoes*—Kerr's Pink, 6 to 7 tons per acre; Golden Wonder, 5 to 6 tons per acre; some disease among Kerr's Pink. *Turnips*—A good crop, 20 to 30 tons per acre; brairded well; finger-and-toe in some cases caused some damage; very little resowing. *Insects*—Very little damage by turnip-fly. *Weeds*—Very little damage caused. *Pastures*—Very good indeed, and where they had been top-dressed with lime and basic slag continued good late in the season. *Live Stock*—Did very well; cattle and sheep were free from disease. *Clip of Wool*—A fair average.

PERTH DISTRICT.

PERTHSHIRE (Central). *Wheat*—More wheat sown to obtain straw for thatch and covering potatoes; yield good, 35 to 40 bushels per acre; straw, 22 to 24 cwt. per acre; seed sown, 4 bushels per acre. *Barley*—Very little grown. *Oats*—Very large acreage grown; yield of grain very good except on some of the poorer old land which was ploughed late; average 48 to 64 bushels per acre; straw, 20 to 22 cwt. per acre. *Harvest*—Started on 18th August, a few days earlier than last year; much time lost through wet weather; sample not so good as last year's as some was a long time in stook; mostly finished by middle of September. *Hay*—A fair crop, not so good as last year's; 1 to 2 tons per acre; mostly secured in good order. *Meadow Hay*—Only fair, and much of it not well got. *Potatoes*—A good crop, average 7 to 8 tons per acre; some disease in earlies and second earlies; main crop freer; those starting early had their crops lifted in fine condition; but later on rain and shortage of pickers prolonged lifting well on into November. *Turnips*—A very good crop, nearly up to last year; swedes, 22 to 28 tons; yellows, 18 to 28 tons per acre; brairded well; no second sowing; very free from disease. *Insects*—No damage caused. *Weeds*—No injury reported. *Pastures*—Very good; much better than last year. *Live Stock*—Did exceptionally well; cattle and sheep were free from disease. *Clip of Wool*—Very much under average.

FIFESHIRE (Middle and Eastern). *Wheat*—About the same as last year; excellent quality of both grain and straw; seed sown, 3 to 4 bushels per acre. *Barley*—Good crop of excellent quality; 40 to 64 bushels per acre. *Oats*—Good crop of excellent quality; 50 to 80 bushels per acre. *Harvest*—Began at usual time, but late farms were hindered by bad weather; average harvest except on late farms. *Hay*—Good quantity and excellent crop, much the same as last year; about 2½ tons per acre. *Meadow Hay*—None grown. *Potatoes*—Not quite so heavy as last year; later varieties like Golden Wonder and Kerr's Pink, 1 to 2 tons less per acre; some disease, especially in Kerr's Pink; Majestic a good crop and free from disease. *Turnips*—Good average crop; brairded well, but did not grow well in autumn; 20 to 25 tons per acre. *Insects*—Injury not specially severe. *Weeds*—No more damage than usual. *Pastures*—Were of average growth and quality. *Live Stock*—Throve well, cattle and sheep being free from disease. *Clip of Wool*—Average, or rather less.

FIFESHIRE (Western). *Wheat*—Winter wheat in later districts was sown under adverse conditions, and severe weather thinned out the growth; average crop, 36 to 48 bushels per acre; straw, soft, average weight; seed sown, 3 to 4 bushels per acre. *Barley*—Delay in spring ploughing affected sowing, and the yield averaged 32 to 40 bushels per acre; straw, soft and light in weight; seed sown, 3 to 4 bushels per acre. *Oats*—Average, 48 to 56 bushels per acre, and where well harvested of good quality both for grain and straw; straw, soft, but of good feeding value; seed sown, 5 to 6 bushels per acre. *Harvest*—Started about the third week of August, 7 to 10 days later than the early harvest of last year; general by beginning of September; weather broke on the 25th, retarding completion till end of October; grain ripened unevenly, and with shortage of labour much of the oat crop was cut before it had hardened; the straw was too green, and there was risk in stacking; crops not secured early were severely damaged. *Hay*—Average return, 2 tons per acre; fair quality despite lack of sunshine; there was difficulty in securing the crop owing to unfavourable weather conditions. *Meadow Hay*—Like ryegrass, the same difficulties of securing the crop were experienced, with consequent loss of weight. *Potatoes*—Yields slightly below the previous year, average 7 to 8 tons per acre; lifting interrupted by wet and frosty weather; some varieties reported as not keeping in the pits; in many cases the crop was lifted before the shaws were dead, and the tubers were too soft for pitting. *Turnips*—A good sound crop of average weight, 16 to 18 tons per acre; slow in brairding, and did not come regularly; no second sowings reported. *Insects*—No damage reported. *Weeds*—Crops were free from injury. *Pastures*—There was sufficient for all stock; they were more lightly stocked owing to the short lamb crop and perhaps to the price of store cattle; feeding quality was good. *Live Stock*—Throve well; cattle and sheep free from disease; several isolated cases of grass sickness amongst horses. *Clip of Wool*—Average.

PERTHSHIRE (Eastern). *Wheat*—Winter wheat in spite of the severe winter was a very good crop, 40 to 50 bushels per acre; seed sown, 4 to 5 bushels per acre; samples good. *Barley*—A good crop; more sown than usual; about the same as last year, 40 to 44 bushels per acre; seed sown, 3 to 4 bushels per acre; samples very good. *Oats*—A very good crop all round; samples quite good, with a good weight per bushel; threshed well, 42 to 70 bushels per acre; seed sown, 4 to 6 bushels per acre. *Harvest*—Began early in August, just about the usual time, but the early part was very protracted owing to broken weather; finished in September. *Hay*—Average, about 40 to 50 cwt. per acre, and secured in fair order. *Meadow Hay*—An average crop; quality good. *Potatoes*—A good crop; some blight in the early varieties; yield, 6 to 9 tons per acre; barely so good as last year; kept well in pits; very few new varieties grown. *Turnips*—An average crop, not quite so good as last year; grew well in autumn owing to the absence of frost; brairded well and practically no resowing needed; swedes, 30 to 35 tons per acre. *Insects*—No damage reported. *Weeds*—Caused no injury, but crops were not so well cleaned as usual owing to the scarcity of casual labour. *Pastures*—Grass came a little later than usual owing to very severe frost; good grazing season which lasted well into autumn. *Live Stock*—Did well; there were a few cases of trouble with early lambing half-bred ewes. *Clip of Wool*—Average and of good quality.

PERTHSHIRE (Western). *Wheat*—Under average, thinned out by severe winter; yield, 30 to 40 bushels per acre; straw, 20 to 25 cwt. per acre; seed sown, 3½ to 4 bushels per acre. *Barley*—More grown than in previous years; good crop; 40 to 50 bushels per acre; seed sown, 3½ to 4 bushels per acre. *Oats*—Good crop, above average; 45 to 50 bushels per acre, with new varieties about 80 bushels per acre; straw, very good quality, 20 to 30 cwt. per acre; seed sown, 5 to 7 bushels per acre, according to variety. *Harvest*—Commenced about usual time, the middle of August; excellent weather, no rain of any account for six weeks; much threshing direct from the stook this year again. *Hay*—Timothy a good crop; 60 to 80 cwt. per acre, green cut, secured in good condition; not so much left for seed owing to action of maggot; threshed well below average; ryegrass, medium crop, 40 cwt. on dryfield, 50 cwt. on carse; well secured; not so much clover in evidence. *Meadow Hay*—Good crop; not very well secured. *Potatoes*—Under average crop, 6 to 8 tons per acre; lifting delayed by wet weather, and many pitted rather wet to keep well; end of season weather improved; more disease than last year; no new varieties grown. *Turnips*—Good crop, 25 to 30 tons per acre; brairded well; not many resowings. *Insects*—Very little damage except by timothy-fly grub, which was bad this year again. *Weeds*—Thistles more obvious, especially in grain crops, due no doubt to shortage of labour. *Pastures*—Average. *Live Stock*—Throve well; cattle and sheep free from disease. *Clip of Wool*—Under average; of fair quality.

PERTHSHIRE (Highland). *Wheat*—Not generally sown; only a few acres on suitable farms. *Barley*—Larger acreage grown than in previous years; yield light and below average; about 25 to 40 bushels per acre. *Oats*—Increased acreage sown; straw of good bulk and quality; natural weight of grain about 42 lb. per bushel; seed sown, 6 to 8 bushels per acre, according to variety. *Harvest*—Began in third week of August, and in most cases was completed within five weeks under fine weather conditions. *Hay*—Crop average, of good quality and well secured; 30 cwt. per acre. *Meadow Hay*—Average as to quantity and quality. *Potatoes*—A larger acreage planted than usual, and a very good crop secured under generally favourable conditions; about 7 to 8 tons per acre; lifting operations somewhat delayed through labour shortage. *Turnips*—Very similar to the previous season; brairded well and quickly, where sown early; little second sowing required; average yield about 20 tons per acre. *Weeds*—Very few, and, where evident, easily kept under control. *Pastures*—Were of good average growth during the season. *Live Stock*—Throve quite well, and were generally free from disease. *Clip of Wool*—Quality varied and under average as to quantity.

ABERDEEN DISTRICT.

ANGUS (Western). *Wheat*—32 bushels per acre; straw and grain good quality; seed sown, 3 to 4 bushels per acre, drilled. *Barley*—40 bushels per acre; straw and grain fair quality, much having been badly lodged; seed sown, 3 to 4 bushels per acre, drilled. *Oats*—52 bushels per acre; straw and grain mostly good quality; seed sown, 4 to 6 bushels per acre, according to variety and district. *Harvest*—Began about the third week in August, and during cutting there was broken weather, which then cleared, and leading was carried through without further interruption in grand weather. *Hay*—2 tons per acre, but not up to quality of last year. *Meadow Hay*—None grown. *Potatoes*—6 to 7 tons per acre; very little disease, and a lot burned down; lifting started in September; no new varieties grown; some early frosts in October, but very little damage done. *Turnips*—22 tons per acre; did well all season, and very little resowing required; quality very good. *Insects*—Damage not greater than last year, when it was negligible. *Weeds*—Damage much as usual. *Pastures*—Average growth and quality. *Live Stock*—Throve well; cattle and sheep more than usually clear of disease. *Clip of Wool*—Good quality and about an average crop.

ANGUS (Eastern). *Wheat*—Quite a good crop, 40 to 48 bushels per acre; rather less straw than usual; well harvested; seed sown, 3½ to 4 bushels per acre. *Barley*—Notwithstanding unfavourable conditions for sowing and a breakdown of the weather during harvest, a satisfactory crop was secured, which threshed out little the worse; seed sown, 3½ bushels per acre. *Oats*—Scarcely so heavy a crop as last year's, average 80 to 88 bushels per acre; the reduction partly accounted for by much of the crop being a second year in oats or oats after hay; weight per bushel quite as high as usual; straw, generally, stood up well; seed sown, 4½ to 6 bushels per acre. *Harvest*—Began about the usual time, 12th to 20th August, but owing to a much bigger acreage on most farms lasted eight to ten days longer than usual. *Hay*—A heavier crop than last year by about 1 ton per acre and well mixed with clover; the earlier-cut crops were got in very good condition, but on most farms a few acres were more or less deteriorated by rain; 3 to 3½ tons per acre; about the average. *Meadow Hay*—Practically none grown. *Potatoes*—Not quite so heavy a crop as last year, about a ton less, or from 8 to 10 tons per acre; a little blight in soft varieties began with wet weather in latter half of September; quality good, but blight got worse in some varieties since being pitted, especially in Kerr's Pink; no new variety of special note. *Turnips*—The weather was bad at sowing-time, and some second seeding was necessary; returns varied from 12 to 25 tons per acre, and there was an unusual amount of finger-and-toe; yellows, although they brairded badly, were healthier as a rule than swedes; all over, the tonnage was far short of average. *Insects*—Very little damage done. *Weeds*—Charlock, 'fat hen,' and couch-grass gave more trouble than usual, especially late in the season, when shortage of labour was felt. *Pastures*—Satisfactory all season, but some ten days later than average in early spring; clover was more abundant and lasted longer than usual. *Live Stock*—Did well on grass in spite of the want of artificial feed; very little disease of any kind has been reported except grass sickness in horses. *Clip of Wool*—Much about an average in quality and weight.

KINCARDINESHIRE. *Wheat*—18 to 24 cwt. per acre; grain and straw of good quality; seed sown, 3 to 5 bushels per acre. *Barley*—14 to 28 cwt. per acre, depending on the district; grain and straw generally good; seed sown, 3 to 5 bushels per acre. *Oats*—15 to 33 cwt. per acre; quality good; seed sown, 6 to 7 bushels per acre. *Harvest*—Later than usual; near the coast harvesting conditions were good, but in later places more difficulty was experienced in securing grain crops as the weather broke down. *Hay*—1 to 3 tons per acre; quality good. *Meadow Hay*—None grown. *Potatoes*—Yield from 6 to 10 tons per acre; slightly more disease than usual, especially in Arran Pilot. *Turnips*—20 to 30 tons per acre; more disease (finger-and-toe) than usual, probably due to lack of lime. *Insects*—Damage less than formerly. *Weeds*—Damage about average. *Pastures*—Of average growth and quality. *Live Stock*—Did well, and there was no complaint of disease among sheep and cattle. *Clip of Wool*—Average.

ABERDEENSHIRE (Buchan). *Wheat*—Very little grown. *Barley*—From 32 to 40 bushels per acre. *Oats*—Varied considerably; 32 to 80 bushels per acre. *Harvest*—Started about end of August in early districts; those who started then had a good harvest; the later cut had a very bad one, and there were some oats not gathered when December came in. *Hay*—A fair crop, from 30 to 45 cwt. per acre. *Meadow Hay*—None grown. *Potatoes*—Less than last year, with a good deal of blight; from 4 to 7 tons per acre. *Turnips*—From 8 to 15 tons per acre; much less than last year; brairded well. *Insects*—No trouble caused. *Weeds*—No damage to speak of. *Pastures*—Average growth, but quality not so good as last year. *Live Stock*—Throve fairly well; cattle and sheep were free from disease. *Clip of Wool*—Average.

ABERDEENSHIRE (Central). *Wheat*—Much the same as last year; quality certainly under average; quantity, 16 to 20 cwt. per acre; straw, poor quality. *Barley*—16 to 18 cwt. per acre; much the same as last year; quality of a much wider range than normally; bushel weights from 48 lb. to 56 lb. *Oats*—15 to 20 cwt. per acre; very varied quality; bushel weights, 38 to 44 lb.; varieties of foreign origin were much worse than our native varieties; straw, very poor and of very low feeding value. *Harvest*—Began in some cases much about the usual time, but in many others was much later; many crops were not secured until November. *Hay*—Quantity on the whole rather less; quality of a very much wider range than in an average season, clover being much more deficient than usual. *Meadow Hay*—Somewhat similar to last year's, or rather poorer. *Potatoes*—6 to 9 tons per acre, of very good quality; Kerr's Pink, Champion, Sharp's Victor, and Golden Wonder are the varieties mostly planted. *Turnips*—Crop varied widely from good to very poor; brairding slow; second sowing very seldom required. *Insects*—No damage reported. *Weeds*—Damage average and not extensive; mostly from surface varieties. *Pastures*—On well-cultivated lands average, perhaps slightly under in clover. *Live Stock*—Did fairly well on good pastures, and no reports received of disease among cattle or sheep. *Clip of Wool*—Varied, and under average in quality and quantity.

ABERDEENSHIRE (Strathbogie). *Wheat*—Only about twelve acres grown; 32 bushels per acre; quality good. *Barley*—Average acreage grown; crops good; yield, 40 bushels per acre, weighing 54 to 55 lb. per bushel; seed sown, 4 to 7 bushels per acre. *Oats*—Crops were slightly better than in 1940; in early places well harvested, but in outlying districts they suffered from the effects of bad harvest weather; yield varied substantially, between 36 and 54 bushels per acre, weighing 38 to 43 lb. per bushel. *Harvest*—Crops secured before the end of September were good, but harvest was very protracted thereafter; almost the end of the year before all were got in. *Hay*—Not much grown; there would be a market for more. *Meadow Hay*—None grown. *Potatoes*—Good quality; yield average; no new varieties grown; staple crops, Kerr's Pink and Golden Wonder. *Turnips*—Crop very satisfactory, and above average; no resowing required. *Insects*—Very little trouble caused. *Weeds*—Gave no trouble; weather favourable for cleaning land. *Pastures*—Abundant, and lasted well into the autumn. *Live Stock*—Did well on pasture, and cattle and sheep were free from disease. *Clip of Wool*—Quality and quantity average; 6 lb. per sheep in some districts. *General*—Weather very stormy during early part of the year with snow and severe frosts; thereafter a wet spell to about the end of April; good harvest weather up to the end of September, followed by continual rain and a protracted harvest. Flax was grown on a number of farms.

BANFFSHIRE (Lower). *Wheat*—Acreage slightly less than last year; yield, about 45 bushels per acre; natural weight, 58 lb. per bushel; straw, 25 cwt. per acre; seed sown, 4½ bushels per acre. *Barley*—Only a fair crop; 32 bushels per acre; natural weight, 55 lb. per bushel; straw, 20 cwt. per acre, of fair quality; seed sown, 4 bushels per acre. *Oats*—A fair crop; 50 bushels per acre; straw of fair quality, 28 cwt. per acre; seed sown, 6 to 7 bushels per acre. *Harvest*—Began about the usual time, but on the later farms did not finish until the end of November. *Hay*—A fair crop; about 30 cwt. per acre; only of medium quality owing to the wet weather after cutting; clovers were deficient. *Meadow Hay*—Practically none grown. *Potatoes*—Crop only about half of last year's; about 5 to 6 tons per acre; blight was reported on many farms about the first week of August. *Turnips*—On some farms a very good crop, on others about average; good quality on the whole; 15 to 18 tons per acre; brairded well; very little resowing. *Insects*—No injury reported. *Weeds*—No damage caused. *Pastures*—Fully up to average both in growth and quality; grazing season lasted longer than usual. *Live Stock*—Throve very satisfactorily, and no disease occurred among cattle and sheep. *Clip of Wool*—Quality good and an average yield.

BANFFSHIRE (Upper). *Wheat*—None grown. *Barley*—Only an acre or so grown for feeding purposes. *Oats*—A bumper crop both as regards grain and straw; 48 to 50 bushels per acre; bushel weight about standard, 42 lb.; usual seeding, 6 bushels per acre. *Harvest*—Commenced about first days of September, but continued over a period of three months due to wretched weather conditions. *Hay*—Crop fairly good, well mixed with clovers; 1½ to 2 tons per acre; partly ruined by wet weather at time of cutting. *Meadow Hay*—None grown. *Potatoes*—Quite a full crop, free from disease; Kerr's Pink mainly grown. *Turnips*—Best crop for several years; 17 to 20 tons per acre; later sowings slow in brairding and came up patchy, but no second sowing had to be done. *Insects*—No serious damage; absence of turnip-fly again noted. *Weeds*—Again fairly plentiful, mainly knot-grass, due to more yavilling of ground. *Pastures*—Quite a fair average throughout. *Live Stock*—Throve well; no disease in cattle; lambs, affected by dysentery, received injection treatment. *Clip of Wool*—Definitely under average, owing to very severe winter.

INVERNESS DISTRICT.

MORAYSHIRE. *Wheat*—A good crop, above average; 42 bushels per acre; quality good; straw, 35 cwt. per acre, of good quality; seed sown, 4 bushels per acre. *Barley*—A fair crop, but the poorest yielding cereal of the season; quality fair to good with some heavy samples; average weight, 53 to 58 lb. per bushel; straw, good quality, 20 cwt. per acre. *Oats*—A good crop; yielded unexpectedly well; on good land up to 80 bushels per acre; on the upland 32 to 48 bushels per acre; quality good; 42 to 46 lb. per bushel; straw good, 25 cwt. per acre; seed sown, 5 to 7 bushels per acre. *Harvest*—Started about a week later than last year. *Hay*—A good crop, where not eaten down by sheep; in the hay-growing district up to 3 tons per acre; on lighter and higher lands, 20 to 25 cwt. per acre; quality good. *Meadow Hay*—None grown. *Potatoes*—Better than last year, about 7 tons per acre, of good quality; not much disease; no new varieties. *Turnips*—Much the same as last season; 10 to 30 tons per acre, of good quality; little second sowing. *Insects*—Little complaint of damage; much injury caused by wood-pigeons. *Weeds*—

More than usual damage. *Pastures*—Stood up well all through the season. *Live Stock*—Did well; cattle and sheep were free from disease. *Clip of Wool*—Average.

NAIRNSHIRE. *Wheat*—Little grown. *Barley*—Average, 30 bushels per acre; seed sown, 3½ to 4 bushels per acre. *Oats*—Yield, 48 bushels per acre; straw, not plentiful; seed sown, 6 to 7 bushels per acre. *Harvest*—Began at usual time. *Hay*—About 1 ton per acre. *Meadow Hay*—Not grown. *Potatoes*—About 9 tons per acre; no disease. *Turnips*—A very heavy yield; no second sowing. *Insects*—No injury recorded. *Weeds*—No damage caused. *Pastures*—Average growth and quality. *Live Stock*—Throve well; a few cases of disease occurred on higher districts, said to be due to infestation by ticks. *Clip of Wool*—About average.

INVERNESS-SHIRE (Inverness). *Wheat*—46 bushels per acre; seed sown, 4 bushels per acre. *Barley*—32 bushels per acre; seed sown, 3½ bushels per acre. *Oats*—34 bushels per acre; seed sown, 7 bushels per acre. *Harvest*—Began at usual time. *Hay*—Under average; secured in good condition. *Meadow Hay*—Poor crop. *Potatoes*—Poor crop; about 4½ tons per acre. *Turnips*—Excellent crop; heaviest for many years. *Insects*—No injury reported. *Weeds*—Damage was done owing to shortage of labour. *Pastures*—Were of average growth and quality. *Live Stock*—Did well; cattle and sheep were free from disease. *Clip of Wool*—Quality good, but under average in weight.

INVERNESS-SHIRE (Skye). *Wheat*—None grown. *Barley*—None grown. *Oats*—A pretty good crop where sowing was done in good time; when sown late, poor in straw and in grain. *Harvest*—Began rather earlier than usual; by the middle of August where sowing was early; late sown lands very slow in ripening, and some never ripened at all. *Hay*—There was a very poor crop of ryegrass and clover hay owing to the barren weather during April and May. *Meadow Hay*—A fair crop, nearly as heavy as last year's, but later in coming to maturity; only a very small proportion was well secured, the weather being even worse than last season. *Potatoes*—A fair crop as to quantity; considerably under that of last year; quality on the whole very good, only a small amount of disease. *Turnips*—Very few grown; small plots of yellows pretty good. *Insects*—Not very much damage done, but a good many potato tubers were injured. *Weeds*—One kind, probably tormentil, was plentiful among oats on poor soil. *Pastures*—Full average growth; although bare till the middle of summer, growth in late autumn was wonderful. *Live Stock*—Were later in putting on flesh, but at the end of the grazing season were in quite as good a condition as usual; there was less disease than usual among cattle in the months of April and May, but there were some cases of trembling in the autumn owing, possibly, to ticks; sheep being poor at the beginning of the year, a good many died. *Clip of Wool*—Under average, the flocks being in poor condition and pastures bare for the first part of the season.

INVERNESS-SHIRE (Lochaber). *Wheat*—None grown. *Barley*—None grown. *Oats*—A good crop generally; grain heavy and in most cases secured in good order, as the weather, although broken, was not bad for rotting. *Harvest*—Started early, about middle of August. *Hay*—About an average crop. *Meadow Hay*—Was late of growing, but came away well after the middle of June, and crops left growing till September were good. *Potatoes*—Yield perhaps a little under average; quality very good; no disease. *Turnips*—Did fairly well and kept well throughout the winter. *Insects*—No damage; indeed there seemed to be a scarcity of insects during the year. *Weeds*—Damage less than average. *Pastures*—Growth better than last year. *Live Stock*—Did well, and cattle and sheep were free from disease. *Clip of Wool*—Very light owing to the severe winter of 1940-41.

ROSS-SHIRE (Dingwall and Munlochy). *Wheat*—On good land a good crop; more grown and threshed well up to average; seed sown, 3 to 4 bushels per acre. *Barley*—Larger acreage grown; yield, 30 to 48 bushels per acre. *Oats*—Larger acreage grown and return above average on good land, but in some cases, where the land was ploughed late, very disappointing. *Harvest*—Generally later than last year, and in most cases very prolonged owing to labour shortage. *Hay*—An average crop, but less grown; quality good. *Meadow Hay*—Practically none grown. *Potatoes*—Acreage larger, but return per acre less; quality good; no disease. *Turnips*—A good crop; better than average; quality good; very little second sowing; not much complaint of disease. *Insects*—No report of damage, but injury by crows and pigeons considerable. *Weeds*—Owing to labour scarcity, damage, especially by thistles and docks, showed signs of increase. *Pastures*—Average. *Live Stock*—Throve well; cattle and sheep were free from disease. *Clip of Wool*—Below the average, owing to the long and severe winter.

ROSS-SHIRE (Tain, Cromarty, and Invergordon). *Wheat*—Generally a very good crop. *Barley*—Good crop for those who finished harvest before the rains came. *Oats*—Good crop; threshed well when taken in dry. *Harvest*—Began a little earlier than usual; but very protracted for those who did not have the labour, and were late in commencing. *Hay*—Good crop, but a lot damaged by rain. *Meadow Hay*—Little or none grown. *Potatoes*—Excellent crop; average yield, 9 to 10 tons per acre. *Turnips*—Very good crop; no disease. *Insects*—Damage very slight. *Weeds*—Land fairly clean. *Pastures*—Grazed well. *Live Stock*—Did well; cattle and sheep free from disease. *Clip of Wool*—Over average.

SUTHERLANDSHIRE. *Wheat*—None sown. *Barley*—A light crop, but quality good; not much sown. *Oats*—A good crop on the whole except on light land, where straw was short; secured in good condition; straw and grain of splendid quality. *Harvest*—Began about the usual time; weather was favourable except on later high land, where crops were somewhat damaged. *Hay*—About 1 ton per acre on good land; 12 to 14 cwt. on poorer soil; very similar to last year; quality, very good. *Meadow Hay*—About the same as last year. *Potatoes*—6 to 7 tons per acre on good land; about the same as last year; crop very healthy; no new varieties planted. *Turnips*—On the better land, 23 to 25 tons per acre; very good sound quality;

much better than last year in bulk and quality; brairded well; with very few exceptions, no second sowing was necessary. *Insects*—Practically no damage. *Weeds*—No serious trouble; less than usual. *Pastures*—Of average growth and quality. *Live Stock*—Both cattle and sheep summered very well, and came off the grass in very good condition; they were very free from disease. *Clip of Wool*—Quality very good, but a very light clip, much below the average.

CAITHNESS-SHIRE. *Wheat*—Very little grown; crops average; yield, 60 bushels per acre. *Barley*—An average crop; grain not so heavy as last year; 40 to 44 bushels per acre; straw, average; seed sown, 4 bushels per acre. *Oats*—Crops good in most districts; grain lighter than last year; 48 bushels per acre; late ploughed and late sown fields gave deficient yields of 12 to 20 bushels per acre; straw, 1 to 2 tons per acre; seed sown, 4 to 7 bushels per acre; many fields of oats damaged and partially lost through inclement weather. *Harvest*—Began at the usual time; cutting was general in the last week of August; operations hampered by unfavourable weather; considerable part of the crop unsecured until the end of November. *Hay*—Not quite so good as last year both as regards ryegrass and clover; quantity, 2 tons per acre. *Meadow Hay*—Rather less productive than last year. *Potatoes*—A good crop; similar to last year; 7 to 8 tons per acre; no evidence of disease; not many new varieties planted. *Turnips*—An average crop; 25 to 28 tons per acre; crop slower in brairding; no resowing necessary. *Insects*—Practically no damage by insects or grub. *Weeds*—Charlock was prevalent in cereal crops; thistles in pastures; no serious damage. *Pastures*—Slower of growth during the spring months; improved in summer and autumn. *Live Stock*—Throve well on pasture; cattle free from disease; sheep subject to attack by the maggot-fly. *Clip of Wool*—Quality slightly under the average.

ORKNEY. *Wheat*—None grown. *Barley*—Grain, 30 to 40 bushels per acre; straw, 25 to 30 cwt. per acre; bushel weight, 40 to 48 lb.; seed sown, 3½ bushels per acre. *Oats*—Grain from 30 to 60 or more bushels per acre; bushel weight, 35 to 40 lb.; extremes, 32 and 43 lb.; seed sown, from 3½ to 6 or 7 bushels per acre, depending on variety. *Harvest*—Commenced during the last week of August, but there was some harvesting in favoured areas somewhat earlier; weather favourable, and it was possible to cut most of the crop by binder, and most was gathered in good condition. *Hay*—About average, 30 to 40 cwt. per acre; clover fairly abundant. *Meadow Hay*—Not important; yield average. *Potatoes*—In most districts very satisfactory; 5 to 10 tons per acre, and in some cases rather more; quality good; no report of serious disease. *Turnips*—15 to 30 tons per acre; quality and quantity much better than last season, except in isolated cases where resowing was necessary and only mediocre crops produced. *Insects*—Only very slight damage reported. *Weeds*—No serious damage caused. *Pastures*—Rather less abundant than usual, especially in the early part of the season owing to the cold, dry weather in May. *Live Stock*—Made reasonably good progress especially during the later months of the grazing season; cattle and sheep were free from disease. *Clip of Wool*—Average quality and quantity.

SHETLAND. *Wheat*—None grown. *Bere*—12 cwt. per acre; quality of grain and straw good average; bushel weight, 49 to 52 lb.; seed sown, 3½ to 4 bushels per acre. *Oats*—Yield of grain, 10 to 13 cwt. per acre; quality of grain and straw similar to last year; lea oats again markedly superior to clean-land oats, especially in quantity of straw; seed sown, 4 to 6 bushels per acre. *Harvest*—Commenced earlier than usual, but almost at the same time as last year, bere in first week and oats in second week of September. *Hay*—'Seeds Hay' crop was good, but quality suffered badly from unfavourable weather during curing; clover not so bulky as last year; 18 to 22 cwt. per acre. *Meadow Hay*—Average crop obtained; superior to that of last year, which suffered from weather conditions. *Potatoes*—Yield good, similar to last year; 5 to 8 tons per acre; little disease, though blight was seen in one or two districts about the third week in July; few new varieties planted; Redskin gave satisfactory results. *Turnips*—Average crop; 12 to 16 tons per acre; quality good; braird was very slow, but in general one sowing was sufficient. *Insects*—The most serious pest, which appeared to be spreading was the cabbage-root fly; evidence of the turnip and carrot root flies also apparent, though not serious. *Weeds*—Attack by weeds such as charlock and couch, normal; field thistles appeared to be more prevalent. *Pastures*—Good; superior to last year's; grass lasted longer throughout the season. *Live Stock*—Due to longer grazing season cattle throve well; very little disease among cattle and sheep. *Clip of Wool*—Quality good; yield about 15 per cent lower than last year's. Demand was great for Shetland wools. Prices: Moorit, 3s. 4d.; White, 3s. 3d.; Black and Gray, 2s. 6d.; Cheviot, 2s. 6d. per lb.

THE WEATHER OF SCOTLAND IN 1941.

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THIS report consists of (1) a general description of the weather from month to month, and (2) a selection of rainfall returns in which each county of Scotland is represented by one or more stations. Temperature readings, unless otherwise stated, are from thermometers exposed in the regulation "Stevenson Screen."

JANUARY.

January 1941, like January 1940, will long be remembered for its intense cold. The cold of 1941 was not so widespread as that of 1940 over Britain as a whole, but at some places in South-East Scotland it was even more intense. In the Tweed valley, trees which had withstood the frosts since 1844 were among the many victims, and for the country as a whole we must go back to 1881 to find a January of comparable severity. The cold was associated with exceptionally persistent northerly and north-easterly winds. These winds, as is usual, gave heavy snowfall in northern and eastern districts, but little in the west. There were 16 days of north-easterly winds and only 4 of south-westerlies.

On the 1st of the month north-easterly winds were bringing some snow to the eastern and northern districts, while in the west weather was cold but relatively clear. A day of light northerly winds on 2nd was succeeded by four, during which southerlies spread in temporarily from the west, giving gales and less cold conditions on the western seaboard. Farther east, however, this was one of the coldest periods of the month. From the 7th to the 9th was mainly quiet and clear. Light northerlies and westerlies, with some heavy rain in the north-west, then introduced a spell of northerly winds. This lasted from 14th to 17th and brought heavy snowfall, especially in north-eastern districts on 15th, with strong winds in the extreme north. On the 18th easterly winds began to spread across the country from the west, and the following day had easterly gales. There was specially heavy snow during this period in Skye. The storms in Scotland had subsided on 20th, though continuing farther south, but they were renewed by the 22nd and continued in the north on the 23rd. There was a relative lull, with, however, strong easterly winds and some rain and snow in parts until 27th-28th, when south-easterly and southerly gales and rain spread across the country from the west. Skies cleared temporarily on the morning of the 30th, and on the 31st the weather was mainly quiet, though there was still strong wind in the Shetlands and rain or snow here and there.

Temperature was very much below the average everywhere in Scotland, especially from the 3rd to the 6th and again in the third week. On the 3rd the temperature in the screen at West Linton (3½ feet above the ground) fell 6 degrees below zero Fahrenheit (38 degrees of frost). On the same day Balmoral and Braemar had 1 degree below zero, and on the 6th and 18th Wolfelee reported zero. Still lower temperatures were recorded by observers using uncertified thermometers. West Linton had continuous frost from the 1st to the 6th and from the 15th to the 20th. In the westerly winds of the 9th to the 13th, day temperature rose, especially in the north. It reached 48 degrees in places on the 11th and at Stonehaven on the 13th, but in the south at West Linton its highest level was 39 on the 10th, 11th, and 23rd. Ground frosts touched 9, 10, and 11 degrees below zero at West Linton on the 3rd, 4th and 6th, and Balmoral reported 7 below zero on the 3rd.

The month was dry over more than three-quarters of the country. The north-easterly winds which prevailed gave rain and snow, exceeding the average east of a line through Elgin, Perth, and Kelso, while west of this line the totals were below the average. In Roxburgh and Berwickshire some places had nearly double their usual amount, whereas much of Argyll and Western Inverness had barely one-tenth of it. The number of days with rain or snow corresponded, several places in the south-east having 20 or more such days, while in the west there were only 6 or 7. Fort William with a monthly total of only 0·34 inch, as against the average of 9·70 inches, was outstanding, and had its driest January for 58 years. Snowstorms were heavy in the north during the third week, parts of Caithness and Sutherland being cut off for several days by drifts 15 feet deep in places. Relief gangs became themselves stranded, and food was dropped from aeroplanes. The whole of Skye was snowed up from the 18th to the 23rd by the heaviest falls since 1916. There were deep drifts down to the water's edge. Balmoral reported 20 inches of snow on the 22nd, and Wolfelee had drifts of 5 feet deep on the 10th and 11th. The 'wettest' days were the 16th, 21st and 22nd, and among the large falls on these days were 1·01 inch at Stornoway on the 16th, 2·33 at Banchory, and 1·69 at Glentanar (Aberdeen) on the 21st, and 1·20 at Rothiemay (Banff) on the 22nd. Hail was reported on the 1st and 2nd and from the 13th to the 31st.

Weather was relatively sunless in the east and over the greater part of south Scotland, while in the west and along the Caledonian Canal sunshine was generally above the average. In the former areas many stations had less than 30 hours of bright sunshine, while in the latter some places had about double the average. Among the smallest totals were 14 hours in Glasgow, 19 at Greenock, and 22 at Ruthwell. On the other hand, Tiree had 67 hours—*i.e.*, 30 hours more than usual. Forres reported 61 hours, Prestwick 59, and Carluke 58.

FEBRUARY.

February, like January, was extremely cold. There was also heavy snowfall, but it was farther south than in January, being spread over the greater part of the region south of the Caledonian Canal. It was specially heavy in the Border country, traffic there being much disorganised. The snow came chiefly with north-easterly winds which were, as in January, exceptionally frequent. There were, however, strong southerly gales on the 4th-5th and the 27th.

Scattered rain, snow, and strong winds occurred on the 1st and 2nd February, followed by clearer quiet weather on the 3rd and early on the 4th, with low temperatures over the north and east mainland. Gales from southward, however, with rain, snow, and some marked increases of temperature, spread rapidly across the country from the west on the 4th-5th, passing away to the east by the 6th, but being followed by another brief, less intense, spell on the 7th. By the 9th the weather had cleared, with westerly winds which were strong in the north. The fair spell lasted until the 11th, but the 12th-15th brought south-easterly gales, rain, and snow. Except in the extreme north, weather was improved on the 16th, but from the 17th to the 20th-21st there were north-easterly winds, strong in parts and with more rain and snow. Lighter winds and clearer, cold weather followed until 26th, when disturbed conditions again approached from the south-west. There was a violent southerly gale on 27th with rain, some snow, and considerably higher temperatures, but except in the extreme north the gale was over by the 28th.

The mean temperature of the month was as much as 4 degrees below the average at many places, and at no place was it up to the average. The coldest spells occurred with the clear quiet weather of the 3rd-4th and the 23rd-26th. In the screen 25 degrees of frost was recorded at Braemar on the 4th, while Balmoral and Glenbranter had 12 degrees. West Linton registered 11 degrees on the 4th and the 25th. The 3rd and 4th had frost throughout the 24 hours at many places; the temperature at Logie Coldstone reached only 28 degrees

Fahrenheit on the 4th, and at Cupar only 29 on the 3rd. The southerly and south-westerly winds brought milder spells between the 7th and the 11th, and from the 27th to the end of the month. During these milder conditions temperature in the screen reached 55 degrees in Edinburgh on the 8th—*i.e.*, 7 degrees higher than at any place in January, and 54 was registered at several stations—namely, Ayr and Dunbar on the 8th, Cupar on the 9th, and Onich and Fort William on the 27th. Night temperatures were also relatively high during the southerly winds of the 7th to the 9th—for example, 46 at Ayr, 44 at Auchincruive and Colmonell, and 43 at numerous other places. Ground frosts were not so universal as in January, but they occurred on every night at one place or another. Braemar recorded the lowest ground temperature—namely, 2 degrees Fahrenheit on the 4th. This was 13 degrees above the lowest (at West Linton) in January. West Linton in February had 3 degrees on the 4th and 5 degrees on the 5th. A reading of 5 degrees was also registered at Braemar on the 25th.

In February rain and snow were more generally distributed than in January. Falls were frequent, and for most parts of the country the monthly totals were well above the average. In Banffshire, along the coasts of Angus and Fife and in Berwick, the amounts were over twice as much as usual. On the other hand, in the west and at a few places in the centre and south, the totals were below average, one or two stations having only about half their usual amount. Snowfall was reported on every day except from the 9th to the 11th. From the 1st to the 5th and the 17th to the 21st, falls were widespread. They were specially heavy in the south during the second period, rail and road traffic both being interrupted. Marchmont reported 26 inches of level undrifted snow, Swinton 18, and Wolfelee 16 to 20 inches. Edinburgh had a fall of 15 inches in three days, the largest amount for forty years. Falls from the 1st to the 5th were greatest in the Central Highlands, and Balmoral had an accumulated depth of 27 inches on the 6th. Daily amounts exceeding the equivalent of an inch of rain were reported on 14 days and in all districts. Outstanding amounts were 2·10 and 2·02 inches at Kinlochquoich and Glenquoich on the 7th, and 2·27 and 2·10 at Fairlie and Garelochhead on the 12th. Hail fell locally on 18 days. It was fairly frequent in the north, both Wick and Lerwick having hail on 6 days.

The month was unusually dull in the Moray Firth area, the sunshine totals at Inverness, Fortrose, and Gordon Castle, for example, being about 25 hours below the average. Fort William, Fort Augustus, Dalwhinnie, and Braemar all registered under 40 hours. On the other hand, in the south and west and at scattered places on the east coast, the weather was fairly bright. Carnoustie reported the largest amount of sunshine—namely, 80 hours. Arbroath had 77 hours, St Andrews and Duntuilm 72, and Edinburgh and Turnberry 71.

MARCH.

Like January and February, March was exceptionally cold. Rain and snow were less than in the preceding two months and occurred chiefly in the east and south-east, the west having mainly dry and sunny weather. The excess of north-easterly winds which was so outstanding a feature of January and February persisted, but became less marked. Gales were less frequent than is usual in March.

There was no outstanding feature for the country as a whole during the first 6 days of March, though strong winds, rain, and fog were recorded in various parts. A north-easterly type of weather occurred during the next three days and there was some rain, but the associated northerly gales did not extend as far north as Scotland. Thereafter weather was mainly fine generally, with higher day temperatures, but fog on the coasts. On the 20th-21st a disturbance gave a south-westerly gale followed by a north-westerly one in the Shetlands, and a brief spell of rain over the country. From then until 25th the weather, though not settled, was mainly fine. The 26th brought south-easterly winds (gales in the north), with rain in the east and very heavy snow in the north-east. These backed through north-east on 28th to north on 29th, bringing quieter but colder weather. The 30th was quiet, with, however, snow locally, and on 31st a fresh disturbance began to affect the western seaboard.

The mean temperature of the month was below average everywhere. It was especially low along the east coast, where the deficit was about 4 degrees Fahrenheit as against about 2 degrees for the country as a whole. Mild spells occurred with the fine weather of the 13th to the 17th, and again with the southerly winds and gales of the 20th to the 22nd. Day temperature during the fine spell was 61 degrees at Forres on the 14th and 15th, Gordon Castle on 14th and Achnashellach on the 17th, and 60 degrees was registered at various stations in the south-west. The coldest weather was mainly during the fine periods about the 5th, the 23rd, and at the end of the month. Balmoral had 18 degrees of frost (14° F.) in the screen on the 30th, Arbroath, Perth, and Kettins 7 degrees (25° F.) on the 5th, and the cold was only slightly less severe at Fort Augustus, Balfron, West Linton, New Galloway, Craibstone, and Achnashellach. Ground frosts were also unusually numerous. The lowest ground temperature reported was 5 degrees (27 degrees of frost) at Balmoral on the 30th.

Precipitation was frequent in the first week, though not in general heavy. There was hardly any from the 8th to the 19th, and the month's totals were below the average over most of the country. The deficiency was greatest in the Western and Central Highlands, many places there having only about one-third of the usual amount. Fort William was outstanding for the first quarter: the total of 8·54 inches was greater than in 1929, when it was only 5·92 inches, but apart from this it was the least since 1875. It compares with a normal of 23·90. To the south of a line from the Tay to Arran, the monthly amounts were equal to or over the average. Edinburgh had the greatest percentage excess, its total of 2·83 being 44 per cent above normal. Snowfall was reported on 24 days, and a severe storm occurred in Sutherland and neighbouring parts of Caithness and Ross on the 26th-27th. It was said to be the worst storm there since 1879. At Tain, level undrifted snow was reported to be 2½ to 3 feet deep. In other districts Balmoral had 8 inches of snow lying on the 1st, 6th and 7th, and Dundee had 5 inches at the end of the month. There were only few heavy falls on individual days, less than a dozen exceeding 1 inch (of water) in the whole country. The largest fall in a day was 1·53 inch at Haddo House (Aberdeenshire) on the 26th. Other comparable amounts were 1·26 at Achfary (Loch More) on the 20th, 1·45 at Craigston (Barra) on the 22nd, and 1·22 at Muirkirk on the 25th. Hail was reported on 17 days, principally in the north and east. It was widespread during the 28th and 29th.

As regards bright sunshine, the month was one of marked contrasts between one part of the country and another. In the west and north-west, and in Banffshire, weather was sunny on the whole, while elsewhere in the east and in the south and centre it was cloudy and dull. Tiree had a total of 159 hours, Duntuilm 148, Stornoway 133, Banff 137, and Gordon Castle 130. The dullest region was on the east coast to the south of Montrose Ness. Here several stations had 40 or 50 hours less than their average. The smallest monthly amounts were 72 hours at Lundin Links and North Berwick and 73 at Dunbar.

APRIL.

The coldness of January to March, due to unusually frequent north-easterly winds, continued in April, but weather was less disturbed than in the preceding three months. Rainfall was below average in most parts, and the last 8 days were without measurable rain, nevertheless in the east of Scotland the weather was exceptionally dull.

Winds were easterly, reaching gale force in the north, with intermittent rain in the east and north until the 4th. Thereafter they backed to northward, and from 6th to 10th the weather was mainly quiet and fine. Belts of southerly winds with rain passed across the centre and north during the 11th-13th, and rainfall with alternating winds (strong locally at times) continued in parts until the 21st. Subsequently there was a mainly fine spell until the end of the month, though this was not without intervals of strong southerly winds and rain here and there.

Mean temperature was about 2 degrees below the average as in March, the actual value being 42·5 degrees Fahrenheit. The mildest weather of the month occurred during the southerly rainy spell from the 11th until about the 21st. At this period 55 degrees was recorded almost generally, and 60 degrees or more in some places. On the 12th, Perth had 63 degrees in the screen, Cupar and Kelso 62 degrees, and St Andrews, Kettins, and Carnoustie 61. Arbroath registered 61 on the 13th and Paisley on the 21st. Nights were mild also, in the southerly winds of the 12th-13th the night minima in the screen being as high as 49 degrees at Nairn, and 48 at Kirkcaldy, Paisley, and Edinburgh. The coldest period at night was in the fine spell during the latter part of the month. Balmoral and Logie Coldstone respectively had 19 and 20 degrees Fahrenheit early on the 24th, Craigston (Barra) 22 on the 1st, and Glenlee (Kirkcudbright) 22 on the 10th. The most marked cold period by day was at the beginning of the month, from 1st to 4th. The highest day temperatures during this period were 40 degrees or less at many stations. Ground frosts were not so universal as in the preceding months, and from the 11th to the 14th none were reported. They were, however, widespread during the cold nights of the last week. Glenlee and Auchincruive both registered temperatures of 12 degrees (20 degrees of frost) on the 28th.

Rainfall in April was below the average in most parts, but was average or slightly greater in Sutherland, along the coast from Aberdeen to the Tay, and in the Glasgow area. Light intermittent rain until the 4th was followed by a dry spell until the 10th. There were then heavier falls generally until the 21st. The last week was dry in the north and west, while showers fell in the east. Snowfall was widespread in the early part of the month, and there were scattered showers during the last week. Balmoral reported 5 inches of snow lying from the 1st to the 6th. The wettest day of the month was the 16th, the largest amounts reported being 1·60 inch at Achnacarry (Loch Arkaig) and 1·44 at Forrest Lodge (Dalry), on the 2nd there was 1·10 inch at Fedderate Reservoir (Aberdeen), on the 10th Achfary had 1·64, and on the 13th Glenquoich reported 1·11. Hail fell on 14 days, being most frequent in the east, and fairly widespread on the 5th, 27th, and 28th.

There was a shortage of sunshine in all parts of the country, and the month's weather was very dull in the east, where Aberdeen had the lowest April total (78 hours) ever recorded there. Many stations in the east reported 50 hours less than their average. Among the small totals were 73 hours at Roslin, 78 at Balerno and Stonehaven, and 83 at Banff and Eskdalemuir. Duntuilm (Skye) had the largest amount (163 hours), Stornoway had 147, or only 3 hours below normal, Oban 127, and Prestwick 124.

MAY.

The cold conditions of the preceding months of the year continued in May, though the north-easterly winds with which the cold had previously been associated were not so prominent. Rainfall was greatest inland, more or less along the axis of the country, the west, especially the islands, having dry, sunny weather, and the east similar fine conditions, though not to the same degree. Gales were few and confined chiefly to northern parts.

Except for some rain and snow locally between the 6th and the 9th, the fine spell of the second half of April continued until 11th May. On 12th-13th a disturbed belt with rain and strong wind reaching gale force in Orkney moved across the country from the north, and on the 14th-16th there was scattered snow, sleet, and hail. The 20th and 25th were fine, but there was rain in one place or another on all other days until the 27th, and it was extremely heavy in parts on the 22nd-23rd. Thunder was widely reported in the south on the 27th. Skye had a gale on the 22nd, and other strong winds were limited mainly to the extreme north, though St Abb's Head reported gale force on the 24th. There was fog in the east and north-east from 27th to 29th, and a short-lived strong blow with some rain in the extreme north on 30th, but the last day of the month was fine.

The mean temperature for the whole country was 48·5 degrees—6 degrees higher than in April, but 1·4 degree below the average for May. The deficit was greatest in the south and south-east, reaching 3 degrees at several stations there. The west and central districts had a spell of warm weather with temperatures of over 70 in the last week. Kilmarnock registered 82 degrees on the 31st, the highest May temperature for Scotland since 1919, and on the same day Paisley, Greenock, and Auchincruive had 79 degrees. In the east, however, a cold foggy drift from the sea kept the temperature down, so that in Edinburgh and other places the readings remained well below 60 degrees until the end of the month. The coolest weather occurred in the fine spell from the 1st to the 3rd, and in the period of snow and sleet showers from the 14th to the 16th.

In both these periods night frosts were general. At Braemar on the 2nd and 3rd temperature in the screen fell to 24 degrees, and Forres and Glenbranter had the same temperature on the 15th. Balmoral had 25 degrees on the 3rd, and Wolfelee on the 15th. Ground frosts were chiefly associated with these two periods, but there were only 5 nights on which ground frost was not registered at any station. The lowest ground temperatures were 14 and 15 degrees respectively at Auchincruive and Glenbranter on the 15th, and 16 degrees at Glenlee on the 16th.

In May rainfall was small over an area including the Western Highlands and extending to the Ayrshire coast. Many places in the east also had less than their average rainfall. Between these two regions from Orkney to the Solway, rainfall was above the average, some places in the Borders having nearly double their usual amount. The dry spell in the west during the last week of April continued until 11th May, and many places had 20 days without measurable rainfall. At Oban, Greenock, and Rothesay the drought lasted for 22 days. In the second half of the month rain fell in most parts, and on the 23rd there was very heavy rain with severe flooding in the Lothians. On this day 4·31 inches was recorded at Preston House (Linlithgow), 3·89 at Morton (Pentlands), and 3·77 at Uphall. Rainfall was heavy also on the 22nd, principally in Kirkcudbrightshire. Snow, sleet, or hail were reported from most parts on the 14th and 15th, snow showers locally on the 7th, 13th, 16th, and 18th, and hail on 10 days.

In sunshine as in rainfall, May was a month of contrasts between different parts of the country. In the west, especially the Hebrides, the weather was bright, and on the east coast also sunny weather prevailed, though it was not so persistent. Over the intervening region sunshine was markedly below the average. As in April, Duntuilm reported the greatest amount, 233 hours. On both the 30th and the 31st the day's total there was practically 15 hours. Stornoway had 202 hours and Oban 194. Among the relatively small totals were 127 hours at Stirling and Boghall, 129 at Braemar, 131 at Fort Augustus, and 132 at Dalwhinnie.

JUNE.

The cold conditions which had continued almost unbroken during the first five months of the year persisted until about mid-June, and were succeeded by an exceptionally hot spell lasting into July. And the drought which had been experienced in many parts almost since the cessation of snowfall, culminated in the hot spell. June was outstandingly dry for the whole country, though not quite so dry as June of 1940. The weather was correspondingly sunny except at a few places in

Orkney, Shetland, Inverness-shire, and the south-east. The month was quiet, no gales being reported except along the western seaboard on the 16th and the 24th.

An anticyclone lay to the North of Scotland at the beginning of the month and winds were light northerly, bringing the prevalent rather cool and mainly fine quiet conditions. Depressions passing eastwards farther south did little more than veer the wind towards east until the 11th-13th, when a depression over Scandinavia gave fresh to strong north-westerlies and rain in the north-east. During the rest of the month, depressions passed intermittently in the vicinity of Iceland travelling in general towards north-east, so that there was a series of alternating southerly and north-westerly winds with spells of rain, but much fine weather, especially in the eastern parts of the country. The only two gales blew from south-west on the 16th and 24th. They were short-lived and confined to the north-western islands. Thunder-storms were widespread in the east, and scattered storms occurred also in the west from the 21st to the 23rd. There was local thunder on 7 other days.

The low temperatures of the first half of the month were more than compensated by the exceptionally high temperatures of the second half, so that the mean for the whole month exceeded the average by about 2 degrees in some parts of the west and centre. During the cold first fortnight, screen temperatures of 29 degrees were registered at Balmoral and Buddonness on the 3rd, and Wolfelee on the 11th. Glenlee had 30 degrees on the 3rd, and at Benmore, near Dunoon, 31 was recorded on the 11th and 12th. Day temperatures were low also ; Dunbar reported maxima of only 46 degrees on the 3rd and 5th, and the Edinburgh area only 1 degree higher on the 3rd. Ground frosts were fairly widespread on the 3rd, 11th and 12th, and local on 12 other nights. The lowest ground temperature was 21 degrees at Glenbranter on the 12th. Balmoral reported 24 degrees on the 3rd and 12th. During the warm weather which really set in about the 20th, screen temperatures (3′ 6″ above the ground) reached 80 degrees or more on the 21st, 22nd, and 29th. The highest readings were 89 at Glenbranter on the 29th, 86 at Ruthwell on the 21st and at Inverness on the 22nd, and 85 at Nairn and Gordon Castle on the 22nd. The warm spell also had high night temperatures. On the 21st Ayr had 64, Marchmont 63, and Gordon Castle and Paisley 61.

June was an outstandingly rainless month, though not quite so dry as June 1940. Everywhere rainfall was markedly below the average. The period from 28th May to 12th June was rainless over practically the whole country. Subsequently from the 13th onwards there were showers, but hardly any large falls. The driest parts were the Moray Firth area, Deeside, and Dumfriesshire. These areas had under one-fifth of their average. Among individual stations, Balmoral had measurable rain on only 6 days, and the total was only 0·27 inch, Nairn had 5 days with a monthly total of 0·32, and Dumfries also 5 with a total of 0·39. There were only 2 days, the 13th and the 22nd, with falls anywhere exceeding 1 inch. At Treen (Skye) there was 1·24 inch on the 13th, and in Roxburgh on the 22nd there was over an inch at four stations, the greatest fall being 1·87 inch at Bowden near Melrose. There were 3 days with hail at a few scattered stations.

Sunshine records during June were good in most parts, although there was a marked lack of it in Orkney, Shetland, the Inverness district, and the south-east. The most favoured area was a wide stretch of country north of a line from Aberdeen to Ayr. In this region many places had over 200 hours' sunshine. Troon had 226, Dalwhinnie and Craibstone 211, Tiree 210, and Perth 209. In the less-favoured regions, Orkney, Shetland, Inverness, and the south-east, North Berwick had only 161—that is, 40 hours less than usual, and other small totals were 131 at Kirkwall, 146 at Inverness, 154 at Lerwick, and 161 at Banff.

JULY.

July was on the whole dull and wet, though the fine weather of June did not really end for the whole country until mid-July. There were more than the usual number of thunder-storms, and rainfall was frequent rather than heavy. The second half of the month had some notable cool nights. No gales were reported.

Until 12th July Atlantic depressions continued to travel north-eastwards in the vicinity of Iceland. Winds were therefore in the main south-westerly, with some intervals of westerlies. The depressions were too far removed to give gales, and rainfall occurred chiefly in the western parts of the country. From the 12th to the 16th, depressions were situated over the British Isles. Winds then varied all round the compass, and rainfall was more general, especially on the 15th-16th. About this period, from the 11th to the 14th, thunder-storms occurred in all districts from Shetland to the Borders. Thereafter until the end of the month, the centres of disturbance lay mainly over or to the north of Scotland, giving alternations of southerly and north-westerly winds with showery rain, thunder, and some fine spells. The air was of northerly origin between the 20th and 23rd, and this was the coldest part of the month. It was followed on the 25th by widespread thunder-storms in the east and south-east. Strong winds for brief periods were reported on various days, almost exclusively in the north-western and northern islands, but these winds did not reach gale force.

Despite the coolness of the second fortnight, mean temperature for July was somewhat above the average in most districts, and as much as 2 degrees above in Fife and parts of Perthshire. The warmest period was from the 10th to the 12th. Temperatures then rose to 75 in most places and were slightly over 80 in some. The highest readings were 85 at Ruthwell, 83 at Glenlee, and 82 at Tongland, Auchincruive, Kilmarnock, and Perth on the 12th. Night temperature was also high, Glenlee, Tongland, and Kilmarnock registering 62 degrees on the 12th, while Perth and many places in Ayr and Renfrew had 61. The coolness of the second fortnight was specially marked from the 21st to the 23rd. Night temperature fell to 38 at Balmoral and Peebles on the 20th and 22nd, and 39 at Glenbranter and Wolfelee on the 22nd. Day temperatures were also rather low, Kirkwall registering only 54 on the 19th, and Rothesay on the 22nd. There were 7 nights of slight ground frost at a few high-level stations, the most marked being at Balmoral, where 27 degrees (5 degrees of frost) was recorded on the 8th and the 20th.

The dry weather of June broke in the west on the 2nd July, and this month was unusually wet, with rain at many places on 20 days or more: Stornoway had 27 wet days. The less rainy periods were the 8th-10th, the 21st-23rd, and the 26th-27th. Rainfall was not, however, as a rule heavy, and while the month's totals in several widely separated areas were considerably greater than usual, in other scattered areas they were below the average. New Deer (Aberdeenshire), Onich, and Kilmarnock had about 50 per cent more than usual, and Wick, Nairn, Marchmont, and Inveraray about 30 per cent less than usual. The wettest day was the 15th, when many places in the west had over 1 inch. The greatest amounts registered on this day were 2·38 inches at Onich and 2·30 at North Ballachulish. There were numerous daily falls exceeding 1 inch at widely distributed places on different days of the month.

July was a dull month during which sunshine was scanty in all districts, except the extreme south. The dullest regions, where the month's totals were 30 or 40 hours below the average, were Shetland, along the Caledonian Canal, round Moray Firth, and in the Lothians. On the other hand, in Dumfriesshire the three stations had more than the average for July, and in Fife also there was some excess. Among the small totals were 104 hours at Lerwick, 105 at Fort William, 106 at Inverness, 115 at Banff, and 124 at Boghall, while among the larger totals were 181 at Kirkcaldy, 175 at Carnoustie, and 174 at Dumfries.

AUGUST.

There was no settled fine weather in August, and, as in July, thunder-storms were above average, but the month was on the whole less unsettled than July. South-westerly and westerly winds, which were more numerous than usual, brought widespread and frequent rainfall, and the accompanying scanty sunshine in most parts of the country was associated with low temperatures for the season. There were some gales.

During August the July series of eastward-moving Atlantic depressions continued, and a brief interval of mainly fine northerly weather was followed by moderate westerly and south-westerly winds with rain until the 4th. The succeeding north-westerlies and northerlies reached gale force at many places round the coast, and lasted until the 7th, on which day, and the 8th, the northerly air with clearing skies gave some low temperatures. Thereafter, more depressions in the vicinity of North Scotland gave alternations of light to moderate southerly and westerly to north-westerly winds with scattered rainfall until the 13th. On this day a depression passed eastwards across the country; rainfall became general, continuing until the 16th; and winds from between north and west increased to a gale along the western seaboard and in the southern part of the country. Conditions remained unsettled in slow-moving or stationary depressions with winds all round the compass and considerable rainfall, but also numerous fine intervals until about the 20th. There followed four or five days of rather indeterminate pressure gradient, light variable winds, with mainly fine weather and some low temperatures until the 25th. Thunder-storms were widespread in the east during part of this period, from the 20th to the 22nd. On the 25th day the series of depressions was renewed, the 26th-27th having strong westerly and southerly winds reaching gale force in the western islands. The disturbances were less intense on 28th-29th, without much wind or rain, and on the 30th-31st conditions were mainly fine again.

Mean temperatures for the month just reached the average in Orkney and Shetland, but elsewhere they were below it. At a few places the deficit was as much as 2 degrees. In general, however, it was small. The weather was warm for the first few days, but subsequently unsettled and cool. During the warm spell, from the 1st to the 3rd, screen temperatures reached 70 in most places, and exceeded 80 at a few in the south and west. On the 1st Newton Stewart registered 82, Glenbranter 81, and Glasgow, Glenlee, and Benmore (near Dunoon) 80. Benmore had 80 again on the 2nd. During the same period, night temperature did not fall below 63 at Greenock on the 1st, and 62 at Dumfries and Glenlee. The coldest days during the rest of the month were the 7th, 8th, and 23rd. Arbroath and Achnashellach registered 38 on the 7th and 8th respectively, and Tarland (Aberdeenshire) on the 23rd. Balmoral and Braemar both had minima of 37 on the 23rd. Maximum temperatures were low also—namely, 53 at Duntuilm (Skye) on the 16th, with 54 at other island stations on the 9th and 13th, and at Gordon Castle on the 16th. There were 9 nights with slight ground frost, mostly at high-level stations.

Showery rain was frequent during the month over the whole country. In the west and north many places had rain on 28 or 29 days, and the south side of Moray Firth received over double its average amount. The August total of 5·70 at Nairn was the greatest recorded there since registration began in 1866. In the Ullapool district also rainfall was double the average. The largest amounts were recorded in the Highlands, many places there having over 10 inches, and Inverinate (Loch Duich) had 12·79 inches. Despite the general wetness, however, rainfall was somewhat below average in an area including the Firths of Forth and Tay and in Shetland. The wettest days were the 15th and 16th. On the 15th heavy falls were widespread. The heaviest falls reported were 2·30 inches at Gartshore (Dumbarton) and 2·13 at Glenkiln Reservoir (Kirkcudbright). On the 16th the heavy falls were more concentrated, being limited to the areas Moray and Nairn. The heaviest falls on this day were 2·31 inches at Glenferness and 2·23 at Kellas. Other large daily amounts were 1·81 inches at Inverie (Loch Nevis) and 1·69 at Glenferness on the 13th, 1·72 at Craigston and 1·65 at Skallary on the 25th, and 1·65 at Kingairloch on the 27th.

August was a very dull month in most parts of the country, and only in Orkney, Shetland, and parts of the east and south did the amount of sunshine reach the average. It was most scanty along the Caledonian Canal and in the outer islands. The largest monthly totals were 180 hours at Carnoustie, 173 at Kirkcaldy, 164 at Arbroath, and 161 at St Andrews. On the other hand, Fort William had only 76 hours, Fort Augustus 80, Stornoway 85 (43 hours below normal), Braemar 91, and Inverness 94.

SEPTEMBER.

The month was fine and remarkably mild; actually warmer than August. September had not been as mild since 1895, and had not been warmer than August since 1890. Weather was, however, dull except near the Moray Firth. Some short-lived gales occurred at exposed places in the west and north.

September had a fairly settled period from the 15th to the 24th, and was more unsettled after the 24th than before the 15th. A belt of scattered rain (with some strong southerly wind in the islands) moved across the country from the south-west on the 1st, but a succeeding disturbance from the 2nd to the 4th affected only the extreme north-west and north. From the 5th to the 8th was mainly fine and quiet in Scotland. The 8th to the 14th was more disturbed, but chiefly in the north where there was intermittent rain and some local strong winds. The 15th to the 25th was not entirely undisturbed in the north, but it was nevertheless a fine spell. On the 26th, however, there was a southerly gale in the western islands, and during the period 26th-29th scattered rain moved across the more northern districts, winds remaining rather strong from south in the northern islands. The 30th was fine generally.

Exceptionally mild weather set in at the beginning of September, and, except for brief cool spells during the fine weather of the third and fourth weeks, persisted until the end of the month. The mean temperature for Scotland as a whole was more than 4 degrees above the average, and at scattered places the excess reached 5 degrees. In the early part of the month temperature was frequently 70 degrees or more by day in all districts. The 4th was the warmest day, Dundee recording 79 degrees in the screen, and Perth and Kirkcaldy 78. Night temperatures were highest during the last week of the month, high night minimum temperatures being 60 in Edinburgh and Perth on the 25th-26th, and at Nairn and Dumfries on the 27th-28th. The only cold nights were those about the 15th and 23rd. Braemar registered 31 degrees on the 16th, Buddonness 32 on the 15th, Balmoral 32 on the 15th and 23rd, and Tarland 32 on the 23rd. Day temperatures were rather low towards the end of the month, Kelso and Wolfelee having only 52 degrees and Marchmont only 53 on the 30th. There were 9 nights of local ground frost. Most of the frosts were slight, but Balmoral registered 24 degrees Fahrenheit (8 degrees of frost) on the 23rd.

September was dry everywhere. In most of Scotland the monthly amounts of rainfall were about half the average, but on parts of the east coast and in the south-east they reached only about a quarter of the average. At some stations the rainfall was very small. Aberdeen for example had only 0·55 inch, which was the same as that of 1894, the lowest ever recorded there. Most of the rain fell in the last week, though there were local showers on the 1st and from the 8th to the 13th. Renfrew and Paisley had 16 rainless days from the 9th to the 24th. There were few daily falls exceeding 1 inch, and these occurred in the west from the 24th to the 29th. On the wettest day, the 27th, Loch Shiel had 2·10 inches, and Broadford (Skye) 1·89. Heavy rainfall in Sutherland on the

9th and 13th gave 1·04 inches and 1·16 inches at Achfary (Loch More), and there were scattered falls exceeding 1 inch on the 24th, 25th, 26th, 28th, and 29th.

Although September was so mild, yet sunshine records were poor, except in a small area on the Moray Firth, where the amount was average or slightly above it. The largest amounts registered were 124 hours at Forres, 123 at Nairn, and 112 at Inverness. On the other hand, south of a line from Peterhead to Kintyre, the shortage was considerable. The month's totals of 75 hours at Aberdeen and 83 at Perth were about 50 hours below normal, and that of 55 at Stirling was 67 hours below. Among other small amounts were 68 hours at Benmore, 73 in Glasgow, and 75 at Renfrew and Lerwick.

OCTOBER.

October was a stormy month, and the first snow of the autumn was reported on the 19th. Its opening was mild like September, but after the first 10 days persistent though not generally heavy rainfall set in with lower temperatures and a succession of strong winds and gales. The west had much bright weather; but the east, less than usual.

The month was unsettled, especially in the second half. Rain with strong wind arrived in the north-west from the Atlantic on the 1st, and on the 2nd a southerly gale was blowing. The disturbance passed quickly, however, and from the 3rd to the 5th the weather was fine generally. Rain recurred in the north and east with widespread thunder on the 6th, and there was much fog along the east coast on the 7th-8th. The 8th also had rather widespread rain in the north. On 9th-10th there was rain and strong easterly wind, more especially in the north and the islands, but also in the south. These decreased on the 11th, and the 12th-13th was mainly fine. A rain-belt moved across the country from the west on 13th-14th, followed by another with strong south and west winds in the islands on the 15th-16th. The west wind reached gale force in the Shetlands for a short time on the 16th-17th, but rainfall had decreased. A relatively local gale with rain blew from S.S.W. at Stornoway on the 17th, and there was some rain also in the east. This was followed on the 18th by another brief gale in the western isles with rain in the west and north, and on the 19th-20th by another wet period culminating on the 20th in violent gales from between south-west and north-west over the whole country. The 21st to 24th was fine except for some hail and rain and (on 22nd) snow along the east coast. On 25th-26th a rain-belt moved southwards followed by northerly winds which were strong in parts, and this was succeeded by another on 27th-28th which brought a cold wave with northerly gales and rain. Yet another followed on 29th with less rain, but a severe northerly gale and equally low temperatures. On the heels of this came sleet, hail, and rain (chiefly in the north and north-east on 29th-30th) with lighter westerly and north-westerly winds and higher temperatures. The 31st was wet in parts of the east and north-east.

The first 10 days of the month were relatively warm, and this more than balanced the rather cool weather of the last week, so that the mean temperature of the month was above the average everywhere. The excess reached about 2 degrees in Fife and along the Clyde. Day temperature rose to 60 or more in all districts except the extreme north during the introductory warm spell. The highest readings reported were 69 at Aberdeen and 68 at Stonehaven on the 2nd, 68 at Turnberry on the 7th, and 67 at Gordon Castle on the 2nd, at Kilmarnock on the 4th, and at Dumfries, Newton Stewart, and Ruthwell on the 7th. Night temperatures were also high. Auchincruive had 57 degrees on the night of the 8th, and during the first week 56 was recorded at many places in the south-west as well as at Onich and Forres. Temperature was notably low on the 11th, but the coldest weather occurred in the last week. On the 24th Braemar and Balmoral registered 20 and 23 respectively at night in the screen, and on the 25th Peebles had 22 degrees and West Linton 23. On the 29th day temperature reached only 40 at Wolfelee, and 41 at Dungavel and West Linton. Except at a few high-level stations, no ground frosts were reported until the 11th, but there were 19 nights with ground frost at one place or another. Frosts were general from the 21st onwards, and in many places severe. Balmoral had 15 degrees on the ground (17 degrees of frost) on the 12th and 14 degrees on the 24th.

October was wet, but rainfall was frequent rather than heavy. Stations in all parts of the country had 20 or more rainy days, even in parts where the month's total was below the average. Lerwick, with a total of only 2·74 inches, and at the other end of the scale, Glenquoich with 11·66 inches, both had 24 days with rain. In most parts the month's totals were about average, though some parts of the east had a marked excess. Along the coast from Dornoch Firth to the Firth of Tay rainfall was 50 per cent above the average. In the Outer Hebrides and Shetland, on the other hand, rainfall was below average. Specially wet periods were the 5th to the 10th, the 13th to the 21st, and the 27th to the 31st. The wettest days were the 9th and the 10th. On the 9th the largest falls were 2·53 at Laggan, 2·41 at Port William (Wigtownshire), and 2·01 at East Riggs (Dumfries). The 10th was especially wet in Aberdeenshire and Kincardine, many stations there having over 2 inches. The largest falls were

2·78 at Craibstone, and 2·48 at Bridge of Dye. Other daily falls of 2 inches or more were 2·00 at Carbost (Skye) on the 15th and 2·05 at Drummuir Castle (Banff) on the 30th. There were numerous falls exceeding an inch on various days principally in the latter half of the month. The first snowfall was reported on the 19th. Local falls followed on the 21st and 22nd, and on each day from the 25th to the 31st. Light snowfall was general along the east coast on the 28th and 29th. Hail fell on 10 days, showers being widespread on the 29th.

During October, bright sunshine was rather above average at most places in the west, while in the east the sunshine totals were nearly all rather below average. The largest total was 105 hours at Carnoustie, but approaching this were 104 at Kirkcaldy, 101 at Dumfries, and 100 at Turnberry and Edinburgh. Among the small amounts were 44 hours at Oban, 54 at Braemar, 63 at Dalwhinnie, and 65 at Fort Augustus.

NOVEMBER.

November was a still more stormy month than October, gales being frequent and severe. There was an excess of winds from easterly directions. This, however, did not prevent temperature from being rather higher than usual in most parts. Weather was dull and frequently wet, but not much duller or wetter than usual except in the east.

Conditions at the beginning of the month were anti-cyclonic with light winds and mainly fine weather. A few falls of rain in the north and north-east during the first three days were followed by more widespread rain over the north of the mainland for part of the 4th. With the approach of an intense Atlantic depression, rainfall was resumed in the north on the 5th, and there were strong westerly winds which increased to a gale (violent in the Shetlands) on the 6th. The wind veered towards north with falling temperatures on the 7th, and the 8th was cold but with less wind. Southerly winds spread over from the west on the 8th-9th, reaching gale force by the night of the 9th, and accompanied by general rain in the north and north-east. There were violent south-easterly gales along the east coast during the 10th-11th, the gale-belt moving northwards and passing beyond the Shetlands by the 14th. Much rain fell along this coast from the 10th to the 14th. After a brief respite the unsettled conditions intensified again on 17th, on which day there was rain over all Scotland and strong south-easterly wind in the Shetlands. The 19th-20th had a lull followed again by strong winds and some rain in the north on and off from the 21st to the 24th. There were strong winds over the mainland, and a violent but short gale with rain in the Shetlands on the 25th. This was followed on the 26th-27th by a more general violent gale over the whole of the extreme north and much rain. Conditions improved later on the 27th, and the 28th-30th was fine.

The mean temperature of the month was average or somewhat above average everywhere, the excess for Scotland as a whole being about 1 degree. During the mildest period, from the 22nd to the 25th, temperatures were over 50 degrees in all districts. The highest reported was 60 at Onich on the 24th, but Fort William and Achnashellach recorded 59, and many other stations similar temperatures on that day. In places the 11th was also mild; Edinburgh then had a day temperature of 57. Nights were mild during the spell in the fourth week, the night minima at some places on the 26th being as high as 51 degrees. There was a cold spell between the 7th and 9th, and local low temperatures on the 16th, 17th, and 29th. Balmoral and Braemar had night minima of 15 (17 degrees of frost), Wolfelee 19, and Tarland 20 on the 9th. Day temperature was also low during this spell, Glasgow and also stations in Aberdeenshire having day maxima of only 36 and 37 degrees on the 7th and 8th. There were 26 nights with ground frosts. Balmoral and Braemar had a temperature of 11 degrees (21 degrees of frost) on the 9th, Onich and West Linton 14 on the 8th, and Glenlee 14 on the 16th.

November was very wet in the east, Aberdeen having nearly double its usual rainfall, but at most places in the west and south rainfall was somewhat below the average. The proportion of rainy days was large, as in October, some places in the east having 25 or more wet days, and few places more than 3 dry days in succession. On the wettest days—namely, the 10th, 26th, and 27th—many places had daily falls of over 2 inches. On the 10th rainfall was heaviest in the north-east, and the largest falls were 2·86 inches at Glen Tanar, and 2·32 at Banchory. The 26th and 27th were very rainy in the Western Highlands. On the 26th Kingairloch reported an exceptionally heavy fall of 4·92 inches, and damage due to flooding. Tyndrum had 2·88 inches and Benmore (Loch Eck) 2·82. Another very heavy fall of 4·25 inches occurred on the 27th at Glendessary. Other outstanding daily amounts were 2·21 at Achnashellach on the 5th, and 2·15 at Glendessary on the 6th. Snowfall was reported on 15 days. On the 7th and the 9th it was fairly widespread, but not heavy. There was hail on 9 days.

November was a very dull month in the east and on the Clyde, but the amount of sunshine reached the average in parts of the south and west. In the former areas the month's totals were from 20 to 40 hours less than usual, and both Aberdeen and Renfrew had their dullest November on record. The total of 19 hours at Aberdeen was less than a third of the average there. Other small totals were 18 hours at Braemar and 23 at Oban and Renfrew. In the brighter areas Duntuilm had 57 hours, Eskdalemuir 56, Turnberry 53, and Auchincruive 52.

DECEMBER.

December more than maintained the exceptionally mild conditions of November, and was the mildest December for 7 years. There were 21 days with west and south-west winds. Like November, it was stormy, but the gales in the main affected the north and west. Rainfall was generally low, and weather bright in the east but dull in the west.

The month opened fine apart from rain and a gale in the outer islands on the 2nd-3rd. The 4th-5th was again fine in most parts, but the 6th brought a violent south-westerly gale to the whole of the extreme north, with widespread snow-showers. The gale veered towards north-west and then north on the 7th with continued snow and rain in many parts of North Scotland, but it moderated on the 8th. The 9th-12th brought intermittent strong winds and rain in the west and north again, and the wind increased to gale force from south for part of the 13th at Stornoway, the gale being renewed over a wider area (including the Shetlands) on the 14th-15th, with widespread rain on 14th. Conditions became less disturbed from the 16th to the 20th, though not without some strong winds and rain in the extreme north. On 21st there was renewed gale from a westerly direction in the islands and the north, and the 22nd had considerable rain. On the 23rd there was a relative lull, only to be followed on 24th by more westerly to north-westerly gales and widespread rain and snow in the extreme north. Christmas Day was fine apart from scattered rain in the early morning, but there was some snow in the north and north-east on the 26th. The 27th-28th was mainly fine and cold, and a brief wet spell in the north and north-east on 29th was followed by fine weather everywhere with a marked increase of temperature on the 30th-31st.

Mean temperature was above normal in all parts despite a cold spell in the last week. The excess was about 2½ degrees for Scotland as a whole, and reached between 3 and 4½ degrees at some places. There were three specially mild spells: on the 2nd-3rd, 10th-12th, and 23rd-24th, in which day temperatures rose well above 50 degrees. Stonehaven registered 59 degrees on the 24th, Oban had 57 on the 10th, and 56 occurred at Helensburgh on the 3rd, Kirkcaldy on the 12th, and at Perth, Montrose, and Aberdeen on the 24th. Night temperatures were also unusually high. Night minima between 45 and 50 degrees were numerous, and Skallary (Barra) reported a night minimum of 51 on the 3rd and 4th. The cold spell from the 26th to 28th brought sharp frost generally. Tarland registered 10 degrees (22 degrees of frost) in the screen, Balmoral 13, Braemar 14, and Buddon Ness 16 on the 28th, and Braemar had 14 again on the 27th. Frost persisted throughout the 24 hours on the 27th in Aberdeenshire, in the vicinity of Edinburgh, and at West Linton and Hawick. There were 27 nights with ground frost. The frosts were widespread in both the first and the last week, and severe in the last week. Craibstone and Braemar registered 8 degrees (24 degrees of frost) on the ground, Balmoral 9 and Inverness 12 on the 28th, and Glenbranter 12 on the 30th.

As regards the rainfall amount, December was a relatively dry month over the greater part of the country. Nevertheless falls of rain or snow were very frequent, especially in the west, where some places had rain every day. The driest areas were along the east coast from Aberdeenshire to Berwickshire, many places there having less than one-quarter the usual amount. Monthly totals were as low as 0·40 inch at Montrose and Swinton (Berwickshire), 0·44 at Dunbar, 0·56 at Carnoustie, and 0·57 at North Berwick. There was slightly more than the average total fall over an area extending from somewhat south of Inverness to Cape Wrath, and Shetland also had a slight excess. Daily measurements nowhere exceeded 2 inches. The largest were 1·80 at Glenquoich on the 12th, and 1·78 at Lochwinnoch on the 26th, but there were a number of others exceeding 1½ inch. Snowfall was reported on 17 days. Snow-showers were widespread on the 6th and 7th and during the last week. There were 18 days with hail, the falls being widely distributed.

The prevailing south-west and west winds which brought December its high mean temperature gave as usual cloudy skies and shortage of sunshine in the west, and relatively sunny weather in the east. Duntuilm, which in the easterly winds of November had the largest sunshine total in Scotland, registered only 9 hours during December, and the total was also 9 in Glasgow. Fort William and Oban had even smaller amounts—only 3 hours each. On the other hand, Craibstone had 61 hours, or 18 hours above the normal, and other good records were 54 hours at Stonehaven, 53 at Dunbar, 51 at Aberdeen, and 46 at Montrose, Roslin, and Edinburgh.

GENERAL NOTES.

The outstanding features of the year taken over all were the shortage of rain in almost all parts and the lack of sunshine. In the last 40 years, for the country as a whole, only 1933 had less rain than 1941. Gales were fewer than usual, but many were severe, especially in February and again in the last quarter.

Outstanding features of the months and seasons were the excessive cold of January and the heavy snowfall of January to March, the drought and coolness of spring over considerable areas, a dull, cool and dry April followed by marked weather contrasts between the east and the west with local floods during an exceptionally quiet May, the very dry, sunny, hot spell of the second half of June, the dull, wet, and thundery July and August, the remarkably mild and dry but dull September, and the storminess and mildness of the last quarter closing with a dry December. Monthly temperatures remained below average until June, but the second half of the year (apart from a cool August) was warmer than usual. Winds from easterly points predominated until April and gave the characteristic contrasts between dull wet weather in eastern parts and sunny weather in the west. These conditions were reversed during July and August and again in December when there was a marked excess of winds from westerly points.

RAINFALL (MEASURED IN INCHES) FOR 1941 AT SELECTED STATIONS IN SCOTLAND.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Shetland—Lerwick	1·12	3·52	1·56	1·56	1·74	1·02	2·49	2·20	2·53	2·74	5·59	5·06	31·13
Orkney—Kirkwall	1·58	3·08	1·03	1·67	1·24	·31	3·15	3·60	2·21	3·07	4·35	4·05	29·34
Caithness—Wick	1·17	2·72	1·51	1·44	·91	·50	1·98	4·13	1·56	3·47	3·21	2·07	24·67
Sutherland—Strathy	4·01	3·18	1·93	1·76	2·07	·68	1·48	5·40	1·42	*	3·00	*	*
Lairg	4·06	3·84	2·88	1·76	2·81	·75	2·55	4·28	1·12	5·53	4·46	4·22	38·26
Ross and Cromarty—													
Fortrose	1·13	2·20	1·78	1·10	2·39	·30	2·31	4·49	1·02	3·89	2·74	2·35	25·70
Tain	2·17	2·64	3·08	1·18	2·52	·31	1·87	4·64	1·17	5·38	3·53	2·89	31·38
Lochcarron	1·25	5·83	2·28	3·83	2·12	2·30	6·79	10·17	3·73	6·61	6·81	9·52	61·24
Stornoway	3·13	4·09	1·39	1·54	·98	·57	3·86	5·19	1·71	3·91	4·30	4·17	34·84
Inverness—													
Inverness	·74	2·03	1·59	1·11	2·80	·33	2·26	5·23	·83	3·66	2·71	3·31	26·60
Fort-William	·34	6·24	1·96	3·74	1·18	1·61	6·03	8·03	3·78	7·53	6·83	8·50	55·77
Glenquoich	·84	6·73	3·57	5·55	2·29	2·93	7·18	11·19	5·22	11·66	11·86	13·37	82·39
Portree	4·00	3·47	5·43	2·21	1·10	2·09	4·95	3·64	3·77	6·60	9·27	6·99	53·52
Nairn—Nairn	·76	1·81	1·69	·84	2·31	·32	1·99	5·70	·70	3·98	2·16	2·07	24·33
Moray—Gordon Castle	2·94	4·47	2·18	1·55	2·44	1·10	3·47	6·27	1·15	4·79	3·56	1·60	35·52
Aberlour (Wester Elchies)	2·84	5·09	1·60	1·22	1·78	·51	3·46	6·29	1·01	5·08	2·56	1·88	33·32
Banff—Banff	2·56	2·72	1·54	1·55	1·91	1·00	4·30	4·19	1·28	3·80	4·71	1·20	30·76
Aberdeen—Peterhead	2·31	3·26	·97	1·94	1·19	1·03	3·21	3·87	·76	5·41	5·36	1·73	31·04
Aberdeen (King's Coll.)	2·52	3·83	1·19	2·16	1·94	·98	2·76	4·81	·55	4·85	5·72	·84	32·15
Balmoral	4·17	2·69	·95	1·59	2·79	·27	3·18	3·27	1·34	3·76	5·15	1·84	31·00
Kincardine—Fordoun	3·71	4·30	2·11	2·66	1·78	1·43	2·80	3·64	·54	6·82	5·62	·77	36·18
Angus—													
Montrose (Asylum)	2·65	4·03	1·49	2·59	1·59	1·35	2·56	3·28	·44	4·83	4·17	·40	29·38
Dundee	2·74	4·37	1·98	1·90	2·49	1·13	3·17	2·86	1·42	4·59	3·55	·84	31·04
Glamis Castle	2·54	4·51	1·54	1·82	2·44	1·48	3·59	3·44	1·07	3·92	5·15	1·55	33·05
Brechin	4·54	5·94	1·77	2·39	2·20	1·36	2·98	3·33	·57	3·84	5·66	1·63	36·21
Perth—Blair Castle	1·15	3·48	1·30	1·25	2·18	·76	2·84	4·08	2·01	3·72	5·56	3·51	32·74
Crieff	2·63	4·69	2·69	1·72	2·76	·32	3·34	3·20	1·88	4·50	4·63	2·86	35·22
Perth	3·02	4·04	2·20	1·47	3·19	·89	3·25	3·03	·98	2·80	2·54	1·52	28·93
Fife—Cupar	2·95	5·28	2·48	2·03	2·73	·74	2·39	2·08	1·07	3·37	3·26	1·50	30·78
Kirkcaldy	1·94	2·96	1·98	·96	2·25	·38	2·55	3·69	·99	2·87	2·49	·98	24·04
Kinross—Loch Leven	2·90	5·19	2·54	1·56	2·70	·78	2·99	3·44	1·05	3·44	3·20	2·15	31·94
Clackmannan—													
Tillicoultry	2·50	3·76	2·70	1·35	3·89	·91	3·04	4·42	1·50	4·62	3·17	2·16	34·02
Argyll—Gruline (Mull)	·71	6·46	2·18	4·25	1·66	2·37	4·64	7·40	5·56	6·29	9·19	6·12	56·83
Oban	·25	3·63	2·37	2·50	1·43	1·54	4·07	5·74	3·12	4·68	5·06	3·56	37·95
Glencoe Gardens	·76	6·34	2·36	3·54	1·85	1·52	7·02	9·24	3·60	8·17	10·87	9·12	64·39
Inveraray	·89	6·44	3·57	3·64	2·69	2·13	3·78	8·38	3·78	8·50	7·99	7·86	59·65
Bute—Rothesay	·62	4·50	2·70	2·19	2·07	1·78	3·47	5·33	2·04	5·33	4·46	3·07	37·56
Stirling—Stirling	1·19	3·50	2·20	1·27	2·98	·78	2·81	2·96	1·66	4·40	4·43	2·78	30·96
Dumbarton—Arrochar	1·25	7·76	2·96	3·26	2·79	1·10	4·30	7·58	3·61	7·46	8·47	5·02	55·56
Helensburgh	1·35	5·27	3·28	2·57	3·48	1·23	3·58	5·73	1·85	6·14	5·29	3·79	43·56
Renfrew—Greenock	·90	5·70	3·01	2·73	2·21	1·30	3·65	5·19	1·92	7·03	6·60	4·04	44·28
Paisley	1·05	3·66	3·36	1·56	3·03	·59	2·55	4·56	1·47	3·74	3·24	2·39	31·20
Ayr—Kilmarnock	·66	2·17	3·02	1·61	3·36	1·23	4·66	5·13	1·84	3·96	2·34	2·07	32·05
Ayr	·44	1·79	2·64	1·42	2·68	1·08	3·19	4·31	1·73	3·52	1·87	1·66	26·33
Muirkirk	·71	3·17	3·88	1·77	4·99	1·30	4·38	7·06	1·67	4·16	3·27	2·74	39·10
Ballantrae	·81	4·50	2·16	1·62	2·51	·68	2·87	3·82	2·36	4·91	4·41	1·56	32·21
Lanark—													
Glasgow (Botanic Gdns.)	1·08	3·11	3·52	1·73	3·03	1·02	2·69	4·74	1·57	3·54	2·72	1·81	30·56
Lesmahagow	·69	3·09	2·79	1·30	4·19	·94	3·86	5·15	·94	3·42	2·40	2·47	31·24
Biggar	·85	2·70	2·30	1·24	4·89	·86	2·43	5·26	1·05	3·17	2·64	1·78	29·17
Linlithgow—													
Houston House	1·90	3·84	2·98	1·10	5·81	·62	3·28	4·06	·88	3·74	1·73	1·68	31·62
Midlothian—													
Edinburgh (University)	2·19	2·82	3·07	1·23	2·93	·88	3·09	2·97	·93	3·26	1·87	1·00	26·24
Gorebridge	2·79	3·43	2·71	1·51	2·66	1·00	2·52	3·41	·78	2·82	2·04	·97	26·64
Oxenfoord Castle	2·17	4·93	2·81	1·33	2·46	·73	2·86	4·39	1·02	3·40	2·66	·81	29·57
Haddington—													
North Berwick	2·30	2·48	3·05	1·01	2·14	1·15	2·81	2·82	·92	2·97	2·17	·50	24·32
Stobshiels Reservoir	2·31	2·85	2·26	1·22	2·33	1·19	2·50	3·08	·80	3·06	3·88	·65	26·73
Berwick—Duns Castle	4·11	6·99	2·98	1·68	2·19	1·07	1·85	3·51	·79	4·35	3·24	·61	33·37
Marchmont	3·25	4·29	2·72	1·75	2·11	1·14	2·23	3·21	·59	4·16	2·84	·54	28·83
Peebles—West Linton	1·39	3·22	2·77	1·66	3·83	·94	2·81	4·07	1·13	3·53	2·54	2·08	29·97
Selkirk—Whitmuir Hall	2·80	4·59	3·19	1·78	2·37	·95	1·87	3·81	·91	3·65	3·64	·93	30·49
Roxburgh—													
Kelso (Broomlands)	3·25	3·01	2·42	1·52	1·90	·70	2·02	3·25	·53	3·53	2·50	·53	25·16
Wolfelee	2·48	4·10	2·39	1·48	2·55	1·31	1·20	5·35	·87	4·35	3·57	1·38	31·03
Dumfries—Dumfries	·98	4·33	3·00	1·67	2·81	·39	3·34	5·76	1·76	4·69	3·48	1·70	33·91
Moniaive	1·66	4·91	3·83	2·29	3·56	1·05	2·70	6·69	3·02	6·45	5·28	3·35	44·79
Langholm	1·45	4·72	4·48	1·86	3·00	·76	2·88	7·21	2·10	6·20	4·72	2·63	42·01
Eskdalemuir	1·65	4·00	4·56	2·93	3·76	1·98	4·67	7·16	2·62	6·43	5·28	3·35	48·39
Kirkcudbright — Castle Douglas (Corbieton)	1·84	3·31	2·52	1·92	3·47	·54	2·75	6·11	2·48	5·28	3·39	2·49	36·10
Carsphairn (Knockgray)	1·86	5·08	3·07	2·04	4·44	·96	3·21	7·62	3·52	5·86	5·68	3·62	47·56
Auchencairn	·83	2·99	3·87	2·07	3·61	·35	4·19	6·43	2·63	5·88	2·85	2·77	38·47
Wigtown—Monreith	1·94	3·41	2·97	1·70	3·16	1·26	3·29	5·47	1·89	5·09	3·23	1·72	35·13

* Not available owing to war-work.

AGRICULTURAL STATISTICS.

NOTE.—Owing to War-time restrictions, details under Tables 1-20 are not available.

EDINBURGH CORN MARKET.

Statement showing the Prices of Wheat, Barley, and Oats for the Year 1941.

The Corn Sales Act of 1921 provides that all sales are to be affected by weight only, and expressed in terms of or by reference to the hundredweight of 112 lb. Experience has proved it to be convenient to quote at a price per 4½ cwt. for Wheat, 4 cwt. for Barley, and 3 cwt. for Oats.

The following statement gives a record of the year's proceedings in Edinburgh Corn Market.

1941.		WHEAT, per 4½ cwt.		BARLEY, per 4 cwt.		OATS, per 3 cwt.	
		Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
January	1	..	..	NO MARKET		..	..
"	8	65 3	..	94 0	82 0	43 6	..
"	15	65 3	..	92 0	58 0	43 6	..
"	22	65 3	..	90 0	58 0	43 6	..
"	29	65 3	..	88 0	58 0	43 6	..
February	5	65 3	..	88 0	58 0	43 6	..
"	12	65 3	..	85 0	58 0	43 6	..
"	19	65 3	..	85 0	58 0	43 6	..
"	26	65 3	..	85 0	58 0	43 6	..
March	5	65 3	..	85 0	58 0	43 6	..
"	12	65 3	..	80 0	58 0	43 6	..
"	19	65 3	..	80 0	58 0	43 6	..
"	26	65 3	..	80 0	58 0	43 6	..
April	2	65 3	..	80 0	58 0	43 6	..
"	9	65 3	..	82 0	58 0	43 6	..
"	16	65 3	..	82 0	58 0	43 6	..
"	23	65 3	..	83 0	58 0	43 6	..
"	30	65 3	..	85 0	58 0	43 6	..
May	7	65 3	..	88 0	58 0	43 6	..
"	14	65 3	..	85 0	58 0	43 6	..
"	21	65 3	..	86 0	58 0	43 6	..
"	28	65 3	..	87 0	58 0	43 6	..
June	4	65 3	..	90 0	58 0	43 6	..
"	11	65 3	..	90 0	58 0	43 6	..
"	18	65 3	..	94 0	58 0	43 6	..
"	25	65 3	..	94 0	58 0	43 6	..
July	2	65 3	..	95 0	58 0	43 6	..
"	9	65 3	..	95 0	58 0	43 6	..
"	16	65 3	..	95 0	58 0	43 6	..
"	23	65 3	..	95 0	58 0	43 6	..
"	30	65 3	..	95 0	58 0	43 6	..
August	6	65 3	58 6	95 0	58 0	41 3	40 6
"	13	65 3	58 6	100 0	..	41 3	40 6
"	20	65 3	58 6	100 0	54 0	41 3	40 6
"	27	65 3	58 6	..	..	41 3	40 6
September	3	65 3	58 6	..	..	41 3	40 6
"	10	65 3	58 6	120 0		41 3	40 6
"	17	65 3	..	125 0	100 0	41 3	40 0
"	24	65 3	..	130 0	115 0	41 3	40 6
October	1	65 3	..	130 0	100 0	41 3	..
"	8	65 3	..	137 6	100 0	41 3	38 0
"	15	65 3	..	132 6	100 0	41 3	38 0
"	22	65 3	..	132 6	105 0	41 3	40 6
"	29	65 3	..	132 6	100 0	41 3	39 0
November	5	65 3	..	135 0	100 0	42 0	40 6
"	12	65 3	..	135 0	100 0	42 0	40 6
"	19	65 3	..	140 0	100 0	42 0	40 6
"	26	65 3	..	145 0	100 0	42 0	40 6
December	3	66 4½	..	155 0	100 0	42 9	40 0
"	10	66 4½	..	155 0	54 0	42 9	40 0
"	17	66 4½	..	155 0	54 0	42 9	40 0
"	24	66 4½	..	150 0	100 0	42 9	40 0
"	31	66 4½	..	150 0	54 0	42 9	40 0

PRICES OF SHEEP SINCE 1818.

TABLE No. 1.—CHEVIOT SHEEP.

Year.	Wethers.					Ewes.					Lambs.				
	s.	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*
1818	28	0	to	30	0	not quoted.					8	0	to	10	0
1819	25	0	„	27	0	15	0	to	17	0	10	6	„	12	0
1820	20	0	„	25	0	16	0	„	17	0	10	0	„	11	0
1821	18	0	„	20	0	14	0	„	16	0	7	6	„	8	0
1822	12	6	„	13	0	8	0	„	8	6	4	6	„	0	0
1823	13	6	„	18	0	7	0	„	10	6	5	6	„	6	0
1824	14	0	„	19	0	7	0	„	9	0	4	6	„	6	0
1825	29	0	„	32	0	15	0	„	19	0	9	0	„	10	6
1826	17	6	„	21	6	13	0	„	15	0	7	0	„	7	6
1827	15	0	„	24	0	not quoted.					7	0	„	8	0
1828	18	0	„	27	6	12	0	to	15	0	7	0	„	8	3
1829	18	0	„	24	0	12	6	„	14	0	7	0	„	8	6
1830	15	0	„	21	0	8	0	„	11	0	6	0	„	6	9
1831	18	0	„	25	0	9	0	„	13	0	7	0	„	8	0
1832	19	0	„	24	0	11	0	„	16	0	7	0	„	9	0
1833	22	0	„	31	0	13	6	„	20	0	8	0	„	11	3
1834	22	0	„	31	0	13	6	„	21	0	9	0	„	11	6
1835	22	0	„	27	6	18	0	„	20	6	8	0	„	11	0
1836	24	0	„	31	6	16	0	„	19	0	10	0	„	14	0
1837	19	0	„	28	0	14	0	„	19	0	10	0	„	13	0
1838	23	0	„	30	6	17	0	„	22	0	12	0	„	14	0
1839	23	0	„	31	0	14	0	„	19	0	0	0	„	13	0
1840	24	0	„	33	0	15	0	„	23	0	7	0	„	11	6
1841	23	0	„	30	0	14	0	„	22	0	8	0	„	12	0
1842	22	6	„	28	0	13	0	„	17	0	7	6	„	10	0
1843	19	0	„	25	0	8	0	„	12	0	5	0	„	8	0
1844	21	0	„	29	0	10	0	„	16	0	8	0	„	10	6
1845	23	0	„	33	0	13	0	„	20	0	8	0	„	13	0
1846	24	0	„	33	6	14	6	„	21	6	10	0	„	14	6
1847	24	0	„	35	0	13	0	„	24	0	11	6	„	15	0
1848	23	0	„	34	6	13	0	„	28	0	11	6	„	15	0
1849	21	0	„	30	2	12	0	„	21	0	0	0	„	14	0
1850	20	6	„	29	6	12	0	„	20	0	8	0	„	13	0
1851	21	6	„	31	0	13	0	„	21	0	8	9	„	14	0
1852	21	0	„	32	0	15	0	„	23	0	8	0	„	14	0
1853	26	6	„	38	0	17	0	„	28	6	9	0	„	17	0
1854	25	0	„	36	0	17	0	„	26	0	9	0	„	16	6
1855	28	6	„	36	0	16	0	„	25	0	10	0	„	17	0
1856	22	0	„	35	6	15	6	„	24	0	10	0	„	15	0
1857	24	0	„	36	0	14	6	„	26	0	10	6	„	14	6
1858	24	0	„	34	6	14	0	„	24	6	10	6	„	14	0
1859	25	0	„	34	6	16	0	„	25	0	10	3	„	14	9
1860	26	0	„	38	0	17	6	„	27	6	12	6	„	17	6
1861	25	0	„	38	6	16	0	„	28	0	9	0	„	16	0
1862	27	0	„	37	6	17	6	„	28	0	10	0	„	16	0
1863	25	0	„	38	6	19	0	„	28	6	10	6	„	16	0
1864	31	0	„	41	0	21	0	„	31	6	14	0	„	18	0
1865	32	6	„	44	0	22	6	„	33	6	14	6	„	20	0
1866	37	0	„	50	0	29	0	„	42	6	15	0	„	26	0
1867	26	0	„	58	0	18	0	„	25	6	12	0	„	16	0
1868	30	0	„	32	0	15	6	„	21	0	7	6	„	13	0
1869	28	0	„	38	0	15	0	„	22	6	7	6	„	14	0
1870	35	6	„	43	0	18	0	„	28	0	10	0	„	17	0
1871	36	6	„	49	0	22	0	„	33	6	14	0	„	20	0
1872	45	0	„	56	0	32	0	„	42	0	16	0	„	22	0
1873	42	0	„	51	0	25	0	„	42	0	15	6	„	22	0
1874	33	6	„	44	6	21	0	„	36	0	12	0	„	17	0

TABLE No. 1.—CHEVIOT SHEEP—*Continued.*

Year.	Wethers.					Ewes.					Lambs.				
	s.	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*
1875	33	0	to	48	6	21	0	to	34	0	13	6	to	23	6
1876	40	0	〃	52	6	23	0	〃	30	0	13	6	〃	25	0
1877	41	0	〃	51	0	25	0	〃	37	0	15	0	〃	24	0
1878	35	6	〃	48	0	23	6	〃	35	0	14	0	〃	22	0
1879	34	0	〃	44	0	21	0	〃	34	0	14	0	〃	20	0
1880	30	0	〃	43	6	20	0	〃	30	0	12	6	〃	20	0
1881	32	0	〃	45	6	29	0	〃	34	0	14	0	〃	20	0
1882	40	0	〃	51	0	30	0	〃	40	0	14	0	〃	20	6
1883	44	0	〃	55	6	34	6	〃	46	6	15	6	〃	23	0
1884	36	0	〃	47	6	29	6	〃	41	6	12	6	〃	20	0
1885	30	0	〃	38	0	24	0	〃	31	0	12	0	〃	18	0
1886	32	0	〃	40	0	21	0	〃	29	0	12	6	〃	19	0
1887	29	0	〃	36	0	18	0	〃	26	0	11	0	〃	16	6
1888	30	0	〃	38	0	19	0	〃	27	0	12	0	〃	17	6
1889	36	0	〃	44	0	24	0	〃	32	0	14	0	〃	22	0
1890	31	0	〃	40	0	22	0	〃	30	0	12	6	〃	20	0
1891	27	0	〃	38	0	16	0	〃	25	0	9	0	〃	16	0
1892	22	0	〃	30	6	13	0	〃	22	0	5	0	〃	11	0
1893	26	0	〃	35	6	18	0	〃	28	6	8	6	〃	15	0
1894	26	0	〃	37	0	20	0	〃	31	0	10	6	〃	18	6
1895	28	0	〃	39	0	22	0	〃	34	0	11	6	〃	19	6
1896	24	6	〃	34	0	19	0	〃	30	6	9	0	〃	16	6
1897	27	0	〃	36	0	21	0	〃	31	6	11	0	〃	17	6
1898	27	0	〃	37	0	22	0	〃	32	6	12	0	〃	18	6
1899	24	0	〃	33	0	20	0	〃	30	6	10	6	〃	16	0
1900	26	0	〃	36	0	22	0	〃	32	6	12	0	〃	17	0
1901	25	0	〃	32	6	20	0	〃	29	6	11	0	〃	16	0
1902	24	0	〃	31	6	18	0	〃	27	0	9	6	〃	14	6
1903	26	0	〃	34	0	21	0	〃	31	0	11	4	〃	18	0
1904	28	6	〃	36	6	23	0	〃	32	6	13	0	〃	20	0
1905	27	6	〃	35	0	23	0	〃	33	0	14	0	〃	21	0
1906	30	0	〃	38	0	26	0	〃	34	6	15	0	〃	23	0
1907	28	0	〃	34	0	22	0	〃	30	6	13	6	〃	19	6
1908	26	0	〃	32	6	21	0	〃	27	6	11	6	〃	17	0
1909	24	0	〃	31	0	18	0	〃	25	6	9	6	〃	16	0
1910	27	0	〃	35	0	22	0	〃	31	0	12	0	〃	20	0
1911	24	0	〃	31	6	18	6	〃	27	6	10	6	〃	18	0
1912	26	0	〃	34	6	22	0	〃	31	0	13	0	〃	21	0
1913	30	0	〃	39	0	24	0	〃	35	6	16	0	〃	24	0
1914	32	6	〃	41	0	28	0	〃	39	0	18	0	〃	27	6
1915	36	0	〃	46	0	31	0	〃	44	0	20	0	〃	30	6
1916	40	6	〃	51	0	34	0	〃	49	0	22	0	〃	34	6
1917	43	6	〃	56	0	38	0	〃	56	0	24	0	〃	34	0
1918	50	0	〃	66	0	42	0	〃	61	0	25	0	〃	37	0
1919	53	0	〃	69	0	44	6	〃	67	0	28	0	〃	40	6
1920	56	0	〃	91	0	48	0	〃	79	0	34	0	〃	49	0
1921	45	0	〃	60	0	52	3	〃	85	9	33	9	〃	52	3
1922	40	0	〃	56	0	56	0	〃	90	6	27	0	〃	50	0
1923	44	0	〃	65	0	61	0	〃	106	0	30	0	〃	62	0

Year.	Wethers.					Ewes.					Lambs.									
											Wethers.					Ewes.				
	s.	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*
1924	41	0	to	61	0	60	0	to	100	0	31	6	to	58	0	40	0	to	85	6
1925	39	3	〃	50	0	56	0	〃	88	9	22	3	〃	50	6	36	0	〃	82	0
1926	35	0	〃	49	3	34	6	〃	64	6	26	3	〃	42	0	28	6	〃	66	6
1927	28	9	〃	46	3	32	6	〃	55	6	23	3	〃	39	0	25	3	〃	52	0
1928	28	3	〃	48	6	30	6	〃	55	6	22	9	〃	47	9	28	0	〃	45	0
1929	33	6	〃	54	6	34	9	〃	52	0	25	6	〃	47	0	30	6	〃	51	9
1930	36	0	〃	54	0	35	0	〃	74	6	24	0	〃	47	3	30	0	〃	59	0
1931	24	0	〃	45	6	23	0	〃	50	9	17	0	〃	37	0	31	0	〃	57	6
1932	16	0	〃	26	6	18	0	〃	36	6	10	0	〃	24	6	12	0	〃	33	0
1933	16	0	〃	28	0	25	3	〃	40	0	16	6	〃	31	6	19	6	〃	33	0
1934	16	0	〃	34	3	22	6	〃	44	6	19	6	〃	33	3	18	6	〃	43	0
1935	22	0	〃	37	3	24	0	〃	44	3	16	0	〃	33	3	17	0	〃	40	6
1936	24	6	〃	50	0	28	0	〃	55	0	18	6	〃	37	6	23	0	〃	49	6
1937	24	6	〃	49	6	29	9	〃	76	6	19	0	〃	45	3	27	0	〃	68	0
1938	17	0	〃	39	6	20	9	〃	64	0	10	9	〃	31	6	16	0	〃	44	3
1939	19	6	〃	42	9	18	6	〃	43	3	11	6	〃	39	9	17	0	〃	48	6
1940	31	0	〃	64	0	22	6	〃	60	0	15	6	〃	41	0	16	0	〃	49	3
1941	36	6	〃	66	9	26	6	〃	71	0	18	3	〃	59	0	23	6	〃	88	0

TABLE NO. 2.—BLACKFACE SHEEP.

Year.	Wethers.					Ewes.					Lambs.				
	s.	d.		s.	d.	s.	d.		s.	d.	s.	d.		s.	d.
1819	22	0	to	24	0	12	0	to	15	0	8	0	to	9	0
1820	20	0	〃	23	3	15	6	〃	17	0	7	0	〃	8	6
1821	18	0	〃	20	0	12	0	〃	13	0	6	0	〃	7	0
1822	11	6	〃	13	6	5	6	〃	6	0	4	6	〃	0	0
1823	12	0	〃	16	0	5	0	〃	6	6	4	0	〃	5	3
1824	9	6	〃	13	6	6	0	〃	7	0	4	0	〃	5	0
1825	22	0	〃	26	0	11	0	〃	13	6	6	0	〃	9	0
1826	15	0	〃	17	0	8	0	〃	9	0	4	6	〃	6	0
1827	14	0	〃	18	6	7	0	〃	10	0	6	0	〃	7	6
1828	15	0	〃	20	0	8	0	〃	11	0	5	0	〃	7	6
1829	14	0	〃	18	0	9	0	〃	10	0	6	0	〃	7	0
1830	9	6	〃	13	0	4	0	〃	6	0	4	6	〃	6	0
1831	13	0	〃	17	0	5	0	〃	7	6	5	0	〃	6	6
1832	14	0	〃	18	0	7	0	〃	11	6	6	0	〃	7	3
1833	16	0	〃	24	0	7	6	〃	12	0	6	6	〃	9	0
1834	16	0	〃	22	0	10	0	〃	13	0	6	0	〃	8	6
1835	15	0	〃	18	9	10	0	〃	13	0	7	0	〃	8	0
1836	15	0	〃	21	0	9	0	〃	12	0	8	6	〃	11	0
1837	13	0	〃	16	0	8	0	〃	12	0	8	0	〃	9	6
1838	15	0	〃	20	6	10	0	〃	13	0	not quoted.				
1839	15	0	〃	22	0	10	0	〃	12	0	7	0	to	8	3
1840	15	0	〃	22	6	11	0	〃	12	0	7	0	〃	9	3
1841	16	0	〃	20	0	9	0	〃	11	0	6	0	〃	8	0
1842	14	0	〃	19	0	7	6	〃	8	0	5	6	〃	7	0
1843	not quoted.					4	9	〃	6	6	not quoted.				
1844	15	0	to	21	0	6	6	〃	10	0	5	0	to	8	0
1845	14	0	〃	23	0	8	0	〃	12	0	6	0	〃	8	0
1846	13	0	〃	24	0	10	0	〃	13	0	8	0	〃	9	0
1847	20	6	〃	25	0	10	0	〃	14	0	8	6	〃	9	6
1848	20	0	〃	24	0	11	3	〃	12	0	8	6	〃	10	0
1849	not quoted.					not quoted.					7	0	〃	7	6
1850			..					..			7	0	〃	0	0
1851	17	6	to	23	0	9	0	to	12	0	6	6	〃	8	0
1852	18	6	〃	22	0	9	6	〃	12	0	4	6	〃	7	9
1853	23	0	〃	27	0	14	6	〃	16	6	8	0	〃	11	6
1854	20	0	〃	26	0	11	0	〃	16	6	8	0	〃	10	6
1855	23	6	〃	26	6	14	0	〃	16	0	10	0	〃	11	0
1856	17	0	〃	24	0	10	0	〃	20	0	7	6	〃	10	0
1857	20	0	〃	29	0	10	6	〃	15	0	9	3	〃	11	0
1858	20	0	〃	27	6	9	9	〃	13	9	8	3	〃	10	6
1859	20	0	〃	25	0	10	0	〃	14	0	8	9	〃	11	0
1860	21	0	〃	27	3	11	0	〃	16	0	10	0	〃	13	6
1861	21	0	〃	29	0	12	0	〃	22	0	6	3	〃	14	0
1862	16	9	〃	27	0	12	0	〃	18	8	6	0	〃	12	0
1863	20	0	〃	30	6	13	0	〃	16	0	8	0	〃	11	6
1864	25	0	〃	30	0	15	0	〃	19	0	10	0	〃	13	6
1865	15	6	〃	32	6	15	0	〃	25	0	10	0	〃	17	0
1866	31	6	〃	40	0	20	0	〃	36	0	13	6	〃	22	6
1867	20	0	〃	30	6	14	0	〃	22	0	7	6	〃	13	6
1868	20	0	〃	26	0	10	6	〃	13	6	7	0	〃	13	0
1869	22	0	〃	28	0	11	0	〃	14	0	6	9	〃	9	0
1870	27	0	〃	32	6	13	0	〃	22	0	8	0	〃	14	6
1871	23	0	〃	37	0	13	0	〃	23	0	11	0	〃	16	3
1872	31	6	〃	45	0	18	0	〃	32	0	12	6	〃	18	0
1873	28	0	〃	39	0	16	6	〃	27	0	7	0	〃	16	0
1874	25	0	〃	35	0	13	0	〃	20	0	7	0	〃	14	0
1875	26	6	〃	37	6	15	0	〃	21	3	9	6	〃	17	6
1876	30	0	〃	40	0	19	0	〃	24	0	13	0	〃	20	6
1877	35	0	〃	38	9	18	0	〃	25	0	13	6	〃	23	0
1878	30	0	〃	36	0	17	0	〃	23	0	12	0	〃	22	0
1879	25	0	〃	35	9	16	0	〃	24	0	10	6	〃	20	0
1880	25	0	〃	38	0	16	6	〃	22	6	10	0	〃	17	0
1881	30	0	〃	39	0	15	0	〃	23	0	10	0	〃	15	0
1882	33	0	〃	46	0	20	0	〃	28	0	12	6	〃	18	6
1883	36	0	〃	50	6	24	6	〃	33	0	14	0	〃	21	6
1884	29	0	〃	43	6	19	6	〃	28	0	12	0	〃	19	6
1885	24	0	〃	34	0	13	0	〃	22	6	10	0	〃	15	0
1886	25	0	〃	34	0	12	0	〃	22	0	10	6	〃	16	0
1887	22	0	〃	30	0	11	0	〃	19	0	8	0	〃	13	0
1888	22	0	〃	32	0	13	0	〃	24	0	10	0	〃	15	0
1889	26	0	〃	40	0	18	0	〃	29	0	13	0	〃	22	0

TABLE No. 2.—BLACKFACE SHEEP—*Continued.*

Year.	Wethers.					Ewes.					Lambs.				
	s.	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*
1890	24	0	to	37	0	14	0	to	27	0	10	6	to	19	0
1891	21	0	"	37	0	10	0	"	24	0	7	6	"	15	0
1892	16	0	"	28	6	6	0	"	17	0	3	0	"	10	0
1893	21	0	"	37	0	12	0	"	24	0	7	0	"	14	0
1894	20	0	"	37	0	14	6	"	26	6	8	6	"	16	6
1895	23	0	"	41	0	16	0	"	28	6	9	0	"	17	0
1896	19	0	"	35	4	13	0	"	24	0	6	0	"	13	6
1897	21	0	"	36	6	15	0	"	25	6	7	0	"	14	6
1898	22	0	"	37	0	16	0	"	26	6	8	0	"	15	0
1899	20	0	"	33	6	13	0	"	24	0	5	6	"	13	0
1900	28	0	"	36	0	16	0	"	26	6	8	0	"	15	6
1901	20	0	"	35	0	14	0	"	25	6	6	6	"	14	6
1902	18	6	"	34	0	12	0	"	24	0	6	0	"	14	0
1903	21	0	"	36	0	15	0	"	28	0	7	0	"	16	6
1904	23	0	"	38	6	18	0	"	30	0	8	6	"	17	6
1905	21	6	"	37	0	19	0	"	31	0	9	0	"	18	6
1906	28	0	"	38	0	20	0	"	33	0	10	0	"	19	6
1907	21	0	"	33	6	17	0	"	28	0	8	6	"	17	6
1908	19	6	"	30	0	15	0	"	24	6	8	0	"	16	0
1909	17	0	"	28	0	11	6	"	22	0	6	3	"	13	0
1910	21	0	"	32	6	16	0	"	27	6	8	0	"	17	0
1911	19	0	"	29	6	14	0	"	24	0	7	0	"	15	0
1912	21	6	"	32	6	17	0	"	27	6	9	6	"	17	6
1913	24	6	"	36	0	21	0	"	31	0	12	6	"	21	6
1914	27	0	"	38	6	25	0	"	34	6	15	6	"	24	0
1915	31	0	"	42	6	29	0	"	39	6	17	0	"	25	6
1916	33	0	"	46	6	31	0	"	42	0	19	0	"	27	6
1917	36	0	"	51	0	33	0	"	47	0	21	0	"	30	0
1918	41	0	"	56	0	36	0	"	50	0	27	0	"	33	0
1919	44	0	"	62	0	39	0	"	54	0	29	0	"	36	0
1920	46	0	"	86	0	44	0	"	62	0	31	0	"	48	0
1921	32	9	"	60	9	35	3	"	62	6	20	3	"	47	0
1922	40	3	"	63	0	40	6	"	74	0	18	0	"	44	0
1923	46	0	"	65	6	43	0	"	78	0	21	0	"	45	6
1924	46	0	"	68	6	45	6	"	85	0	25	0	"	55	6
1925	36	0	"	60	0	40	0	"	78	0	17	6	"	44	0

Year.	Wethers.					Ewes.					Lambs.									
											Wether.					Ewe.				
	s.	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*
1926	30	0	to	54	0	31	0	to	70	0	21	9	to	40	0	19	0	to	50	0
1927	26	6	"	48	0	26	0	"	64	0	17	9	"	40	0	17	6	"	37	9
1928	29	0	"	45	9	24	0	"	57	0	16	6	"	38	6	17	0	"	38	9
1929	29	9	"	46	0	29	0	"	64	0	20	9	"	43	0	18	0	"	37	6
1930	31	6	"	45	0	28	6	"	60	0	20	0	"	45	9	20	0	"	37	6
1931	19	6	"	29	9	15	0	"	38	0	14	3	"	36	9	16	6	"	40	6
1932	12	0	"	19	6	15	0	"	20	0	7	3	"	13	6	7	0	"	14	6
1933			..			20	0	"	34	0	12	9	"	19	3	11	0	"	18	3
1934			..			22	6	"	44	0	16	0	"	25	3	16	6	"	24	3
1935			..			26	0	"	40	0	16	0	"	26	9	10	0	"	23	0
1936			..			27	6	"	48	0	18	6	"	37	6	16	0	"	29	0
1937			..			32	0	"	54	0	22	6	"	39	3	21	6	"	34	0
1938			..			22	0	"	50	0	12	6	"	28	0	10	6	"	25	0
1939			..			17	6	"	40	0	12	6	"	24	6	12	0	"	24	0
1940			..			22	6	"	50	0	16	0	"	35	3	14	6	"	28	6
1941			..			27	6	"	52	6	19	0	"	45	0	21	6	"	46	0

TABLE No. 3.—PRICE OF WOOL, PER STONE OF 24 LB., SINCE 1818.

Year.	Laid Cheviot.	White Cheviot.	Laid Highland.	White Highland.
	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
1818	40 0 to 42 2	..	20 0 to 22 6	..
1819	21 0 „ 22 0	..	10 0 „ 10 3	..
1820	20 0 „ 22 0	..	9 0 „ 10 0	..
1821	18 0 „ 20 0	..	9 0 „ 10 0	..
1822	12 6 „ 14 6	..	5 0 „ 6 6	..
1823	9 0 „ 10 6	..	5 0 „ 5 9	..
1824	13 6 „ 15 0	..	6 0 „ 6 3	..
1825	10 6 „ 22 0	..	10 0 „ 10 6	..
1826	11 0 „ 14 0	..	5 0 „ 5 6	..
1827	11 0 „ 14 0	..	5 6 „ 6 9	..
1828	8 0 „ 11 0	..	5 6 „ 6 0	..
1829	8 6 „ 11 0	..	4 3 „ 0 0	..
1830	9 6 „ 11 0	..	4 6 „ 5 0	..
1831	17 0 „ 20 0	..	7 6 „ 8 6	..
1832	14 0 „ 16 0	..	7 0 „ 7 6	..
1833	18 0 „ 20 7	..	10 0 „ 11 0	..
1834	21 0 „ 24 6	..	5 6 „ 7 0	..
1835	19 0 „ 20 6	..	9 6 „ 10 8	..
1836	21 0 „ 25 0	..	10 0 „ 14 0	..
1837	12 0 „ 14 0	..	7 0 „ 7 8	..
1838	19 0 „ 22 6	..	6 0 „ 10 0	..
1839	18 0 „ 20 0	..	8 0 „ 12 0	..
1840	15 0 „ 0 0	..	7 0 „ 0 0	..
1841	15 0 „ 16 9	..	6 0 „ 7 5	..
1842	12 6 „ 14 0	..	not quoted.	..
1843	9 0 „ 11 6	..	5 0 to 6 0	..
1844	15 0 „ 18 0	..	not quoted.	..
1845	14 6 „ 17 6	..	7 6 to 8 6	..
1846	12 0 „ 14 6	..	8 0 „ 8 6	..
1847	12 6 „ 14 0	..	not quoted.	..
1848	9 6 „ 11 0	..	4 9 to 0 0	..
1849	12 0 „ 16 6	..	6 0 „ 6 3	..
1850	15 0 „ 17 6	..	8 0 „ 8 6	..
1851	12 0 „ 16 0	..	8 0 „ 9 3	..
1852	13 0 „ 15 0	..	8 0 „ 9 0	..
1853	19 0 „ 22 0	..	11 0 „ 12 6	..
1854	12 0 „ 15 0	..	7 6 „ 8 6	..
1855	14 6 „ 19 0	..	8 6 „ 9 0	..
1856	19 0 „ 21 6	..	11 0 „ 0 0	..
1857	19 0 „ 24 0	..	13 0 „ 14 3	..
1858	15 0 „ 17 0	..	8 9 „ 10 0	..
1859	18 6 „ 24 0	..	10 9 „ 11 6	..
1860	22 0 „ 32 0	37 0 to 38 0	10 0 „ 11 3	..
1861	19 6 „ 27 0	from 30s. upwards.	not quoted.	..
1862	18 6 „ 26 0	30 0 to 37 0	11 6 to 16 0	..
1863	25 6 „ 31 0	38 0 „ 42 0	15 3 „ 17 6	..
1864	31 0 „ 39 0	47 0 „ 54 0	17 6 „ 20 0	..
1865	23 0 „ 30 0	44 0 „ 45 0	15 0 „ 17 0	..
1866	24 0 „ 30 0	30 0 „ 33 0	14 0 „ 16 0	..
1867	16 0 „ 21 6	not quoted.	not quoted.	..
1868	19 0 „ 26 0	28 0 to 32 0	8 6 to 9 0	..
1869	18 0 „ 26 6	not quoted.	8 6 „ 10 0	..
1870	15 0 „ 23 6	25 0 to 26 0	9 6 „ 0 0	..
1871	20 0 „ 26 6	30 0 „ 34 6	12 0 „ 15 0	..
1872	26 0 „ 37 6	40 0 „ 48 0	18 0 „ 21 0	..
1873	17 0 „ 18 0	34 0 „ 40 0	9 0 „ 12 0	..
1874	18 6 „ 26 6	30 0 „ 34 0	9 6 „ 13 0	..
1875	25 0 „ 32 0	34 6 „ 36 0	12 6 „ 16 0	..
1876	20 0 „ 24 0	30 0 „ 34 6	9 6 „ 12 0	..
1877	20 9 „ 26 0	28 0 „ 30 0	10 0 „ 12 0	..
1878	18 9 „ 25 0	27 0 „ 32 0	8 6 „ 11 6	..
1879	15 0 „ 17 0	prices very low.	7 0 „ 0 0	..
1880	20 0 „ 24 0	30 0 to 32 0	10 6 „ 11 6	14 0 to 15 0
1881	17 0 „ 21 0	27 0 „ 30 0	5 0 „ 9 6	12 0 „ 13 0
1882	14 0 „ 18 0	27 6 „ 28 0	7 6 „ 9 0	13 0 „ 14 0
1883	13 0 „ 18 0	26 0 „ 28 0	6 6 „ 8 6	11 6 „ 12 6
1884	13 0 „ 18 0	26 0 „ 28 0	6 6 „ 8 6	11 6 „ 12 6
1885	12 0 „ 17 0	22 6 „ 26 0	6 0 „ 8 0	11 6 „ 12 0
1886	13 0 „ 18 0	23 0 „ 27 6	6 6 „ 8 6	11 6 „ 12 0
1887	14 0 „ 22 0	23 0 „ 28 0	7 0 „ 9 0	11 6 „ 13 0
1888	13 0 „ 20 0	23 0 „ 28 0	7 0 „ 9 0	11 0 „ 12 6

TABLE No. 3.—PRICE OF WOOL—*Continued.*

Year.	Laid Cheviot.					White Cheviot.					Laid Highland.					White Highland.				
	s.	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*
1889	13	0	to	18	0	24	0	to	28	0	7	0	to	9	0	11	0	to	12	6
1890	13	0	"	18	0	24	0	"	28	0	7	0	"	9	0	11	0	"	12	6
1891	12	6	"	18	0	22	0	"	28	0	7	0	"	9	0	11	0	"	12	6
1892	12	0	"	18	0	20	0	"	28	0	7	0	"	8	6	10	6	"	12	0
1893	12	0	"	17	0	20	0	"	27	0	7	0	"	8	0	10	0	"	12	0
1894	12	0	"	16	0	20	0	"	26	0	7	0	"	8	0	10	0	"	12	0
1895	12	0	"	16	0	20	0	"	25	0	7	0	"	8	0	10	0	"	11	6
1896	11	0	"	15	0	19	0	"	24	0	7	0	"	8	0	10	0	"	11	6
1897	11	0	"	14	0	18	0	"	23	0	7	0	"	8	0	10	6	"	12	0
1898	10	0	"	13	0	16	0	"	20	0	7	0	"	8	0	10	0	"	11	6
1899	10	0	"	13	0	13	0	"	18	6	7	0	"	8	0	8	6	"	9	6
1900	9	9	"	12	0	13	0	"	18	6	6	9	"	7	9	8	0	"	9	6
1901	9	0	"	10	0	11	0	"	16	6	5	9	"	6	6	8	0	"	9	0
1902	9	0	"	10	0	11	6	"	17	0	6	0	"	6	6	8	6	"	9	6
1903	10	0	"	12	0	15	0	"	18	0	7	0	"	8	0	11	6	"	12	6
1904	15	0	"	17	0	20	0	"	21	0	9	0	"	10	0	14	0	"	15	0
1905	17	0	"	20	0	24	0	"	26	0	10	0	"	11	0	15	0	"	16	0
1906	18	0	"	21	0	27	0	"	28	6	11	6	"	13	0	16	6	"	17	6
1907			*			22	0	"	24	0	11	0	"	12	6	16	0	"	17	0
1908			*			16	0	"	18	0			†			8	0	"	8	6
1909			*			24	0	"	26	0			†			12	6	"	14	0
1910			*			25	0	"	30	0			†			13	0	"	14	6
1911			*			25	0	"	30	0			†			13	0	"	14	6
1912			*			24	0	"	29	0			†			14	0	"	15	0
1913			*			25	0	"	30	0			†			17	0	"	18	0
1914			*			24	0	"	29	0			†			15	0	"	15	6
1915‡			*			42	0	"	46	0			†			21	0	"	22	0

* No Cheviots smeared now. † No Highlands smeared now. ‡ These are July prices.

PRICE OF WOOL PER STONE OF 24 LB.—*Continued.*

		CHEVIOT.				HALF-BRED.				BLACK-FACE.		CROSS-BRED (BLACKFACE EWE AND LEICESTER RAM).			
		HOGG.		EWE AND WETHER.		HOGG.		EWE AND WETHER.		HOGG.	EWE AND WETHER.	HOGG.		EWE AND WETHER.	
		Washed.	Un-washed.	Washed.	Un-washed.	Washed.	Un-washed.	Washed.	Un-washed.			Washed.	Un-washed.	Washed.	Un-washed.
		s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
[1] 1916	. . .	36 6	30 0	33 0	27 6	34 6	28 6	33 0	27 6	23 0	23 0	28 6	25 6	28 6	25 6
	CAITHNESS & SUTHERLAND	40 0	32 6	34 0	29 0	35 0	29 0	34 0	28 6						
[1] 1917	. . .	40 6	33 0	37 0	31 0	38 6	31 6	37 0	31 0	25 6	25 6	31 6	28 6	31 6	28 6
	CAITHNESS & SUTHERLAND	44 6	36 0	37 6	32 6	39 0	32 6	37 6	31 6						
[1] 1918	. . .	43 6	35 6	39 6	33 0	41 0	33 6	39 6	33 0	27 0	27 0	33 6	30 6	33 6	30 6
	CAITHNESS & SUTHERLAND	47 6	38 6	40 0	34 6	41 6	34 0	40 0	33 6						
1919	. . .	84 0	70 0	82 0	66 0	82 0	62 0	70 0	58 0	34 0	34 0	46 0	39 0	44 0	38 0
	CAITHNESS & SUTHERLAND	88 0	74 0	84 0	68 0	84 0	63 0	72 0	60 0						
1920	. . .	86 0	70 0	83 0	66 0	74 0	54 0	65 0	50 0	24 0	24 0	35 0	29 0	34 0	27 0
	CAITHNESS & SUTHERLAND	90 0	74 0	87 0	68 0	76 0	56 0	68 0	52 0						
1921	. . .	22 0	17 0	19 0	15 0	18 6	14 6	16 0	13 0	9 6	9 6	12 0	10 0	12 0	10 0
	CAITHNESS & SUTHERLAND	23 0	18 0	20 0	16 0	19 6	15 6	17 0	14 0						
1922	. . .	30 0	25 0	26 0	22 0	26 0	20 0	22 0	18 0	16 0	16 0	16 6	15 0	16 6	15 0
	CAITHNESS & SUTHERLAND	31 6	26 0	27 0	23 0	27 0	21 0	23 0	19 0						
1923	. . .	41 0	34 0	36 0	30 0	33 0	27 0	30 0	25 0	17 6	17 6	20 0	18 0	20 0	18 0
	CAITHNESS & SUTHERLAND	43 0	35 0	37 0	31 0	34 0	28 0	31 0	26 0						
1924	. . .	58 0	49 0	53 0	45 0	49 0	40 0	45 0	39 0	25 6	25 6	34 6	30 6	33 0	30 0
	CAITHNESS & SUTHERLAND	60 0	50 0	54 0	46 0	50 0	41 0	46 0	40 0						
1925	. . .	39 0	34 0	36 0	30 0	33 6	28 6	32 0	27 0	25 6	25 6	26 0	23 6	25 6	23 0
	CAITHNESS & SUTHERLAND	40 0	35 0	37 0	31 0	34 0	29 0	33 0	28 0						
1926	. . .	35 0	29 0	32 0	28 0	32 0	26 6	28 0	24 6	19 0	19 0	22 6	20 0	22 0	19 6
	CAITHNESS & SUTHERLAND	36 0	30 0	33 0	29 0	33 0	27 6	29 0	25 6						
1927	. . .	38 0	31 0	35 0	31 0	34 6	29 6	32 0	27 6	24 0	24 0	27 0	25 6	27 0	25 0
	CAITHNESS & SUTHERLAND	39 0	32 0	36 0	32 0	35 0	30 0	33 0	28 6						
1928	. . .	51 0	43 0	48 0	41 0	47 0	40 0	43 0	37 0	24 6	24 6	33 0	31 0	32 0	30 0
	CAITHNESS & SUTHERLAND	52 0	44 0	49 0	42 0	48 0	41 0	44 0	38 0						
1929	. . .	37 0	32 0	34 0	29 0	34 0	29 0	32 0	27 0	24 0	24 0	27 0	25 0	26 0	24 0
1930	. . .	23 0	19 0	22 0	18 0	21 0	17 6	20 0	16 6	12 0	12 0	17 6	15 6	16 6	15 6
1931	. . .	16 6	13 6	15 6	13 0	15 0	13 0	13 6	11 6	11 0	11 0	12 0	10 6	11 6	10 0
1932	. . .	14 6	11 6	14 0	11 6	12 6	11 6	11 6	9 6	8 0	8 0	9 0	8 6	8 0	7 6
1933	. . .	20 0	17 0	19 0	16 0	18 0	16 0	17 0	14 0	11 6	11 6	12 0	11 0	11 6	11 0
1934	. . .	21 6	17 6	21 0	17 0	19 0	17 0	17 0	14 0	10 0	10 0	12 0	11 0	12 0	11 0
1935	. . .	26 0	21 0	24 6	19 6	21 6	19 0	19 0	17 0	10 6	10 6	14 0	12 6	14 0	12 6
1936	. . .	27 0	22 0	25 6	20 0	21 6	19 0	19 0	17 0	14 0	14 0	17 0	16 0	17 0	16 0
1937	. . .	39 0	35 0	38 0	33 6	34 6	32 0	34 6	31 6	26 0	26 0	32 0	29 0	32 0	29 0
1938	. . .	22 0	19 6	21 6	18 6	21 0	18 6	20 0	18 6	12 0	12 0	16 0	14 6	16 0	14 6
1939	. . .	26 0	22 0	25 6	21 6	24 0	21 6	23 6	21 6	15 0	15 0	21 0	19 0	21 0	19 0
[1] 1940	. . .	37 0	30 6	37 0	30 6	33 0	29 6	33 0	29 6	25 0	25 0	28 6	26 0	28 6	26 0
[1] 1941	. . .	42 0	35 6	42 0	35 6	37 6	34 0	37 6	34 0	29 0	29 0	33 0	30 0	33 0	30 0

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[1] The prices given were prices fixed by Government, and not free market prices.

Premiums awarded by the Society, 1941.

VETERINARY DEPARTMENT.

Class Examinations, 1941.

Silver Medals were awarded to the following:—

GLASGOW VETERINARY COLLEGE.

Chemistry	Andrew Wilson, Lennoxtown.
Biology	Joan M. Wilson, London.
Senior Anatomy	David Buntain, Croy.
Junior Anatomy	Joseph Parker, Skelton.
Physiology	C. A. Hartman-Smith, Bearsden.
Zootechny	C. A. Hartman-Smith, Bearsden.
Pathology	J. B. Bayliss, Wishaw.
Hygiene	G. W. Serth, Shellingthorpe.
Surgery	Robert Auld, Stewarton.
Medicine	Alexander C. Anderson, Glasgow.
Histology	Peter S. Hastie, Rutherglen.
Pharmacology	Robert M. Wilson, Ballynure.
Parasitology	Patrick J. Quigley, Glasgow.

13 Large Silver Medals, £14, 12s. 6d.

ROYAL (DICK) VETERINARY COLLEGE.

Chemistry	D. L. Grant, Tamworth.
Biology	H. P. Harding, Pembey.
Senior Anatomy	W. J. M. M‘Cormick, Belfast.
Junior Anatomy	P. D. I. Thomas, Skewen.
Physiology	L. J. P. Duncan, Aberdeen.
Zootechny	K. J. R. MacLennan, North Ferriby.
Pathology	A. H. Hogg, Balerno.
Hygiene	R. R. A. Coombs, Cape Town.
Surgery	J. A Laing, Neville's Cross.
Medicine	J. Cruickshanks, Kirriemuir.
Histology	L. J. P. Duncan, Aberdeen.
Pharmacology	R. R. A. Coombs, Cape Town.
Parasitology	R. S. Comline, Hawick.

13 Large Silver Medals, £14, 12s. 6d.

LOCAL GRANTS, &c., 1941.

19 Districts—	Grants of £15 each for Stallions engaged	£285	0	0
	Special Grants: Medals, £16, 4s. 3d.	90	7	3
	Medals for Stewartry Dry Stane Dyking Competition.	3	7	6
	Medals for Scottish Gardens and Allotments Competition	4	2	6
	Medals for Young Farmers' Clubs and Women's Land Army, Ploughing Competitions	6	0	6
2 ,,	Medals for Hoeing Competition, 1940-41	0	19	0
1 ,,	Medal for Ploughing, 1940-41	0	12	0
Long Service Certificates, £23, 18s. 4d.; and Silver Medals, £21, 17s. 6d. (1940-41)		45	15	10
		£436	4	7

ABSTRACT OF PREMIUMS.

Local Grants	£390	8	9
Long Service Awards	45	15	10
Veterinary Colleges (26 Medals)	29	5	0
	£465	9	7

STATE OF THE FUNDS

OF

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

As at 30th NOVEMBER 1941

GENERAL FUNDS.

I. British Government Securities—						
£25,000 3½ per cent War Loan, at 104⅝				£26,156	5	0
£1,679, 13s. 4d. 2½ per cent Consolidated Stock, at 82¼				1,381	10	5
£20,000 3½ per cent Conversion Loan, at 106¼				21,250	0	0
£2,500 3 per cent Do. do. at 102¾				2,568	15	0
£5,000 3 per cent Funding Loan, at 100 11/16				5,034	7	6
£1,000 3 per cent Defence Bonds, at 101⅞				1,018	15	0
£10,000 3 per cent War Loan, at 101¼				10,125	0	0
				£67,534	12	11
II. Heritable Bond—						
£2,500 at Commissioners' Rates				2,500	0	0
III. Railway Debenture and Preference Stocks—						
£17,050 London and North-Eastern Railway Co. 3 per cent Debenture Stock, at 77	£13,128	10	0			
£11,554 Do. do. 4 per cent do., at 102	11,785	1	7			
£16,105 London Midland and Scottish Railway Co. 4 per cent Debenture Stock, at 104¼	16,789	9	3			
£1,500 Do. do. 4 per cent Preference Stock, at 67¾	1,016	5	0			
£703 Southern Railway Co. 4 per cent Debenture Stock, at 111	780	6	8			
£450 Do. do. 5 per cent Preference Stock, at 105	472	10	0			
£112 Do. do. 5 per cent Guaranteed Stock, at 126	141	2	5			
				44,113	4	11
IV. Bank Stocks—						
£5,365 0 0 Royal Bank of Scotland Stock, at 426 x.d.	£22,854	18	0			
£2,218 16 5 Bank of England Stock, at 372½	8,265	2	2			
£1,777 0 0 Bank of Scotland Stock, at 58s. 9d.	5,219	18	9			
2,850 "B" Shares, Barclays Bank, Ltd., at 72s. 10½d.	10,384	13	9			
				46,724	12	8
V. Colonial Government Stocks—						
£2,000 Western Australia 4 per cent Inscribed Stock (1942-62), at 100⅞	£2,017	10	0			
£2,000 New Zealand Government 5 per cent Inscribed Stock (1946), at 104¾	2,095	0	0			
£1,120 Victorian Government 3½ per cent Consolidated Inscribed Stock (1929-49), at 99½	1,114	8	0			
				5,226	18	0
VI. Corporation Mortgage—						
£5,000 on Loan to Edinburgh Corporation, at 4 per cent, maturing Martinmas 1944				5,000	0	0
VII. Temporary Loan—						
£2,000 on Loan to Edinburgh Corporation				2,000	0	0
VIII. Estimated Value of Building—						
8 Eglinton Crescent				5,000	0	0
IX. Estimated Value of Furniture, Paintings, Books, &c.				1,500	0	0
Carry forward				£179,599	8	6

Brought forward	£179,599 8 6
X. ARREARS OF SUBSCRIPTIONS considered recoverable	537 19 0
XI. BALANCES at 30th November 1941	1,522 17 3
AMOUNT OF GENERAL FUNDS	£181,660 4 9

SPECIAL FUNDS.

TWEEDDALE GOLD MEDAL FUND—		
£605 London and North-Eastern Railway Co. 4 per cent Debenture Stock, at 102		£617 2 0
£100 3 per cent Local Loans Stock, at 95¼		95 5 0
Sum on Deposit Receipt with British Linen Bank		45 19 1
		£758 6 1
FIFE AND KINROSS PERPETUAL GOLD CHALLENGE CUP FUND—		
£268 London and North-Eastern Railway Co. 3 per cent Debenture Stock, at 77	£206 7 3	
£201 Do. do. 4 per cent First Guaranteed Stock, at 88⅞	178 12 9	
Sum on Deposit Receipt with British Linen Bank	86 5 4	
		471 5 4
PAISLEY PERPETUAL GOLD CHALLENGE CUP FUND—		
£802 London and North-Eastern Railway Co. 3 per cent Debenture Stock, at 77	£617 10 10	
Sum on Deposit Receipt with British Linen Bank	47 5 7	
Do. Current Account do.	100 0 0	
		764 16 5
RENFREWSHIRE PERPETUAL GOLD CHALLENGE CUP FUND—		
£668 London and North-Eastern Railway Co. 3 per cent Debenture Stock, at 77	£514 7 2	
Sum on Deposit Receipt with British Linen Bank	47 4 11	
Do. Current Account do.	100 0 0	
		661 12 1
WILLIAM TAYLOR MEMORIAL PRIZE FUND—		
£401 London and North-Eastern Railway Co. 3 per cent Debenture Stock, at 77	£308 15 5	
Sum on Deposit Receipt with British Linen Bank	43 8 8	
Do. Current Account do.	100 0 0	
		452 4 1
WILLIAM DUTHIE PERPETUAL SILVER CHALLENGE CUP FUND—		
£260 2½ per cent Consolidated Stock, at 82¼	£213 17 0	
Sum on Current Account with British Linen Bank	13 0 0	
		226 17 0
THE JAMES ARCHIBALD PRIZE—		
£612, 1s. 6d. 3½ per cent War Loan, at 104⅝	£640 7 6	
Sum on Deposit Receipt with Royal Bank of Scotland	21 12 4	
Do. Current Account do.	10 14 2	
		672 14 0
KINMONTH GOLD QUAICH FUND—		
£46, 13s. 6d. 3½ per cent War Loan, at 104⅝	£48 16 7	
Sum on Current Account with British Linen Bank	3 2 4	
		51 18 11
AMOUNT OF SPECIAL FUNDS		£4,059 13 11

EDINBURGH, *7th January* 1942.—As Auditor of the Highland and Agricultural Society of Scotland, I have examined the Securities for the Investments as detailed in the above State of the Funds and have found them in order. The Titles to the Heritable Estate and the Bond for Sum lent on Heritable Security are certified by the Society's Law Agents to be in order. GEO. JAMES GREGOR, C.A.

HOME, *Treasurer.*
F. J. CARRUTHERS, *Hon. Secretary.*

ABSTRACT of the ACCOUNTS of the HIGHLAND and

CHARGE.

1. Balances at 30th November 1940		£605 1 2
2. Arrears of Subscriptions outstanding at 30th November 1940	£443 10 6	
Whereof due by Members who have compounded for life, and whose arrears are thereby extinguished	51 7 0	
		392 3 6
3. Interest and Dividends—		
(1) Interest—		
On Heritable Bond, less Income-tax	£50 7 10	
On Railway Debenture and Preference Stocks, do.	890 18 4	
On Colonial Government Stocks, do.	113 6 5	
On British Government Stocks, do.	1,586 0 3	
On Mortgage, do.	100 0 0	
On Temporary Loans, do.	15 0 1	
	£2,755 12 11	
(2) Dividends on Bank Stocks, less Income-tax	953 10 9	
		3,709 3 8
4. Subscriptions—		
Annual Subscriptions	£1,937 11 0	
Life Subscriptions	847 7 0	
		2,784 18 0
5. 'Transactions'—Miscellaneous Sales and other Receipts		25 15 9
6. Income-tax repaid for year to 5th April 1941		2,216 19 6
7. Balance of Receipts from Edinburgh Show, 1939		8 0 0
8. N.D.D. Examination at Ayr, 1940—Refund of Expenses		114 0 2
9. Miscellaneous		1 13 3
Sum of Charge		£9,857 15 0

Edinburgh, *7th January* 1942.—As Auditor of the Highland and Agricultural
of the Society for the year ending 30th November 1941 and have found them to be
Accounts I have prepared an Account of Charge and Discharge of the Intromissions
1941, of which the above is an Abstract.

AGRICULTURAL SOCIETY of SCOTLAND for Year 1940-1941.

DISCHARGE.

1. ESTABLISHMENT EXPENSES—		
Salaries and Wages and Allowance for Cleaning		£3,086 5 11
Allowance to Mrs Cowie		100 0 0
Feu-duty, £16, 15s. 7d.; Rates and Taxes, £107, 10s. 6d.		124 6 1
Coal, Gas, and Electric Light		84 14 8
Insurances, £62, 18s. 5d.; War Damage Insurance (Business), £253, 11s. 6d.; Special Annuity Premium, £51, 3s. 9d.; Superannuation Scheme, £123, 10s. 0d.; Telephone and Telegrams, £45, 13s. 11d.; Repairs and Furnishings, £80, 11s. 0d.		617 8 7
		£4,012 15 3
2. FEE to Auditor of Accounts for 1939-1940		120 0 0
3. EDUCATION—N.D.A. Examination, 1941		126 19 10
4. CHEMICAL DEPARTMENT—		
Fee to Chemist	£100 0 0	
Analyses for Members and Expenses	156 17 3	
		256 17 3
5. VETERINARY DEPARTMENT—Medals to Students		29 5 0
6. DAIRY DEPARTMENT—N.D.D. Examination, 1940		75 1 0
7. DAIRY DEPARTMENT, 1941—		
Expenses of N.D.D. Examination held at Ayr	£257 8 4	
Less Entry Fees	78 4 6	
		179 3 10
8. SOCIETY'S 'TRANSACTIONS'		1,175 6 2
9. ORDINARY Printing, £174, 10s. 6d.; Advertising, £41, 13s. 3d.; Stationery, Books, &c., £65, 5s. 9d.; Postages and Receipt Stamps, £103, 12s. 5d.		385 1 11
10. RETIRING Allowance to Professor Stanfield, Consulting Engineer		150 0 0
11. AIR RAID PRECAUTIONS		13 19 3
12. MISCELLANEOUS Payments		158 17 6
13. BALANCE of Expenses in connection with Edinburgh Show, 1939		17 0 0
14. GRANTS to Local Societies, 1940		342 18 6
15. CERTIFICATES and Medals for Long Service		45 15 10
16. SPECIAL GRANTS—		
Animal Diseases Research Association, £200; Glasgow Veterinary College, £100; Scottish Agricultural Organisation Society, £100; Scottish Red Cross Agriculture Fund, £76, 18s. 8d.; other Grants, £87, 2s. 0d.		564 0 8
17. EXPENSES in connection with Show Plant, &c.		42 19 9
18. ARREARS removed from Subscription List at 30th November 1941		101 2 0
19. ARREARS of Subscriptions outstanding at 30th November 1941		587 19 0
20. BALANCES at 30th November 1941—		
On Account Current with Royal Bank of Scotland—		
Edinburgh Account	£1,430 1 2	
In hands of Secretary	92 16 1	
		1,522 17 3
SUM OF DISCHARGE		£9,857 15 0

Society of Scotland, I beg to report that I have examined the Books and Accounts correctly stated and sufficiently vouched and instructed. From the Books and of the Treasurer with the Funds of the Society for the year ending 30th November

GEO. JAMES GREGOR, C.A.

HOME, *Treasurer.*
F. J. CARRUTHERS, *Hon. Secretary.*

ABSTRACT of the ACCOUNTS of the

CHARGE.

I. **Funds** at 30th November 1940—			
£3,193 London and North-Eastern Railway Company 3 per cent Debenture Stock			£2,650 0 0
£5,551, 16s. 3d. 3½ per cent Conversion Stock			4,216 18 2
£500 Queensland 3½ per cent Inscribed Stock, 1950-70			450 1 0
£412 London Midland and Scottish Railway Company 4 per cent Debenture Stock			611 10 6
£190 London Midland and Scottish Railway Company 4 per cent Guaranteed Stock			259 1 11
			£8,187 11 7
Balances with Royal Bank of Scotland—			
On Account Current		£188 9 4	
On Deposit Receipt		414 17 4	
			603 6 8
			£8,790 18 3
II. **Interest on Investments**—			
On £3,193 London and North-Eastern Railway Company 3 per cent Debenture Stock, for year to 30th June 1941		£95 15 10	
Less tax		46 14 0	
		£49 1 10	
On £5,551, 16s. 3d. 3½ per cent Conversion Stock, for year to 1st October 1941	£194 6 2		
Less tax	89 17 3		
		104 8 11	
On £500 Queensland 3½ per cent Inscribed Stock, 1950-70, for year to 1st July 1941	£17 10 0		
Less tax	8 10 7		
		8 19 5	
On £412 London Midland and Scottish Railway Company 4 per cent Debenture Stock, for year to 30th June 1941	£16 9 6		
Less tax	8 0 9		
		8 8 9	
On £190 London Midland and Scottish Railway Company 4 per cent Guaranteed Stock, for year to 30th June 1941	£7 12 0		
Less tax	3 10 4		
		4 1 8	
			175 0 7
III. **Interest on Deposit Receipts**			4 2 4
IV. **Income-tax** repaid for year to 5th April 1941			140 19 3
Sum of Charge			£9,111 0 5

Edinburgh, *7th January* 1942.

ARGYLL NAVAL FUND for the Year 1940-1941.

DISCHARGE.

I. ALLOWANCES to eight Recipients—			
8 at £40 each			£320 0 0
II. FUNDS at 30th November 1941—			
£3,193 London and North-Eastern Railway Company 3 per cent Debenture Stock .		£2,650 0 0	
£5,551, 16s. 3d. 3½ per cent Conversion Stock .		4,216 18 2	
£500 Queensland 3½ per cent Inscribed Stock, 1950-70		450 1 0	
£412 London Midland and Scottish Railway Company 4 per cent Debenture Stock .		611 10 6	
£190 London Midland and Scottish Railway Company 4 per cent Guaranteed Stock .		259 1 11	
		£8,187 11 7	
Note.—The above Funds are entered at cost price. The market value at 30th November 1941 was £9,470, 0s. 4d.			
Balances with Royal Bank of Scotland—			
On Account Current . .	£403 8 10		
On Deposit Receipt . .	200 0 0		
		603 8 10	
			8,791 0 5
SUM OF DISCHARGE . .			£9,111 0 5

HOME, *Treasurer.*
F. J. CARRUTHERS, *Hon. Secretary.*
GEO. JAMES GREGOR, C.A., *Auditor.*

VIEW OF RECEIPTS AND PAYMENTS for Year 1940-1941.

RECEIPTS.

INTEREST AND DIVIDENDS	£3,709	3	8
INCOME TAX REPAID for year to 5th April 1941	2,216	19	6
	£5,926	3	2
ANNUAL SUBSCRIPTIONS AND ARREARS received	1,690	13	6
	£7,616	16	8

PAYMENTS.

ESTABLISHMENT EXPENSES (see page 241)	£4,012	15	3			
FEE TO AUDITOR for 1939-1940	120	0	0			
CHEMICAL DEPARTMENT	256	17	3			
VETERINARY DEPARTMENT	29	5	0			
EDUCATION	267	4	6			
RETIRING ALLOWANCE TO CONSULTING ENGINEER	150	0	0			
SOCIETY'S 'TRANSACTIONS'	1,149	10	5			
ORDINARY Printing, Stationery, Advertising, and Miscellaneous Accounts	608	5	2			
GRANTS TO LOCAL SOCIETIES, &c.	388	9	4			
	£6,982	6	11			
Extraordinary Expenditure—						
Special Grants (see page 241)	564	0	8			
				7,546	7	7
SURPLUS				£70	9	1
Extraordinary Income—						
Life Subscriptions				847	7	0
EXCESS OF RECEIPTS				£917	16	1

HOME. *Treasurer.*
F. J. CARRUTHERS, *Hon. Secretary.*
GEO. JAMES GREGOR, C.A., *Auditor.*

EDINBURGH, *7th January* 1942.

PROCEEDINGS AT BOARD MEETINGS.

MEETING OF DIRECTORS, 2ND APRIL 1941.

Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh, in the Chair.

Present.—Ordinary Directors—Mr R. Scott Aiton ; Mr J. W. Alexander, M.V.O. ; Major R. F. Brebner ; Mr Alexander Clark ; Mr James Clark ; Mr Peter Gordon ; Mr R. Wemyss Honeyman ; Mr James Hope ; Mr John Kerr ; Mr James Kilpatrick ; Mr James R. Lumsden ; Mr Finlay MacGillivray ; Mr Thomas M'Lay ; Mr A. W. Montgomerie ; Mr Alexander Murdoch ; Mr Robert Park ; Mr James Paton ; Mr G. H. Russell ; Mr J. Faed Sproat ; Mr Thomas Templeton ; Mr T. G. Wilson. *Extraordinary Directors*—Mr J. E. Kerr ; Mr William Montgomery ; Sir Joshua Ross-Taylor ; Major Robert W. Sharpe ; Mr James Wither. *Treasurer*—The Earl of Home, K.T. *Chemist*—Mr J. F. Tocher, D.Sc., LL.D., F.I.C.

The late Mr James M'Laren, Cornton.

Before proceeding with the business of the Meeting, the Chairman said it was with very deep regret that he had to refer to the death, since their last Meeting in January, of an esteemed colleague on the Board—Mr James M'Laren of Cornton, Bridge of Allan.

Mr M'Laren's connection with the Society, he said, extended over a period of fifty years. He first joined the Board of Directors in 1912, serving as an Ordinary Director until 1915. After a lapse of four years he again joined the Board as an Ordinary Director in 1919, and was a Director continuously from that date up to the time of his death. He was Chairman of Directors in the years 1928 and 1929, a member of all the Standing Committees, and one of the Society's representatives on the National Agricultural and Dairy Examination Boards. He acted as Steward of Sheep at many of the Annual Shows.

In all these capacities Mr M'Laren rendered valuable service to the Society. He took a deep interest in all its activities and never spared either time or trouble where he could serve the Society or further its interests. He was unfailing in his attendance at the Meetings of the Board and of its Committees and could ever be relied upon for wise counsel and advice in any difficulty.

As a breeder of Blackface Sheep he was known throughout the whole of Scotland, and his services were in demand as a Judge and as a Valuator of sheep stocks. His advice on sheep-farming was often sought by young farmers, who derived great benefit from his knowledge and wide experience. His kindliness of manner and helpful disposition rendered him esteemed by all with whom he came in contact. His death was a loss to Agriculture and especially to the Society which he served so long and so faithfully.

A Minute of regret and sympathy was submitted and adopted, the members present upstanding, and the Secretary was instructed to forward a copy thereof to the widow and family of the deceased.

Future of Agriculture.

The Chairman submitted the following Motion, which appeared under his name on the Agenda of the Meeting :—

> "That a Committee be appointed to discuss what steps should be taken by the Society towards the consideration of post-war agricultural conditions in Scotland."

In submitting the Motion, the Chairman said they would remember that at last Meeting he brought this matter before the Directors informally. At the subsequent Meeting of Members of the Society, it was raised by Mr W. J. Campbell. Personally, he thought the proper procedure at this stage was to appoint a Committee of Directors to explore what steps the Society might take to investigate the subject.

One of the main points to be considered, he said, was the question of stable prices for the produce of the soil. That was something they had never had in the past, and he felt they could never have a prosperous agriculture unless they could have stable conditions in the industry.

Another main point was the question of capital—capital to equip a farm with the necessary buildings, fencing and drainage, and capital to stock it properly. Where that capital was to come from would be one of the chief questions to be dealt with in any consideration of post-war conditions.

Conditions of housing must also be considered, as the land had to be made attractive for the worker to reside on. That was one of the things that had been neglected in the past.

Mr Peter Gordon, Balcraig Moor, seconded.

After other speakers, including Mr James Wither, Mr James Hope, and Mr James Paton, had dealt with certain points, the Motion was unanimously adopted, and the following Committee was appointed, with power to add to their number: Major R. F. Brebner, *Convener;* Mr Ian M. Campbell; Mr James Durno; Mr W. I. Elliot; Mr Alexander Murdoch; Mr James Paton; Sir Joshua Ross-Taylor; Major R. W. Sharpe; Mr T. G. Wilson; The Earl of Home, K.T.; Colonel F. J. Carruthers.

Farmers and Excess Profits Tax.

The Chairman said they would remember that Mr W. J. Campbell made a suggestion, at the Anniversary General Meeting, that the Society should appoint a Committee to consider the question of Agricultural Taxation, particularly with regard to the 100 per cent Excess Profits Tax. Personally, he thought that was a matter outwith the scope of the Society, and that no action should be taken.

Mr J. W. Alexander, M.V.O., of Newton, supported the Chairman's view. He had no doubt, he said, that the question would be reviewed by the Committee which had just been appointed.

It was unanimously agreed to take no action.

Scottish Red Cross Agriculture Fund.

The Secretary, reporting on the progress of the Fund, said that the first year of operations terminated on 17th April, after which a full report would be submitted. Up to date, a total sum of £115,311, 5s. 10d. had been received, which was a remarkable result. Of this sum there had been handed over to the Scottish Branch, British Red Cross Society, £91,610, 2s. 5d., and to the St Andrew's Ambulance Association, £23,202, 10s. 7d.

Animal Diseases Research Association.

An application was submitted from the Animal Diseases Research Association for a renewal of the Grant of £200 for the current year.

On the recommendation of the Finance Committee it was agreed that the Grant be renewed.

Glasgow Veterinary College.

An application for a renewal of the Grant of £100, for the current year, to the Glasgow Veterinary College, was submitted, and it was decided, on the recommendation of the Finance Committee, that the Grant be renewed.

Finance.

A Minute of Meeting of Finance Committee, dated 2nd April, was submitted and approved.

The Minute dealt with the following matters:—

Bracken Investigation.—An application from Dr Tocher had been considered for a Grant not exceeding £50 to defray the cost of appliances and material for an investigation which he proposed to carry out regarding a reputed poisonous substance in bracken. The Committee recommended that the Directors authorise a Grant not exceeding £50 for the current year—the money to be paid over on production of vouchers for the outlays.

Scottish Red Cross Agriculture Fund.—The Committee recommended that the expenses incurred in connection with the activities of the Scottish Red Cross Agriculture Fund during the past year, amounting to a sum of £76, 18s. 8d., be defrayed by the Society.

Control of Mastitis, Contagious Abortion, &c.

A Minute of Meeting of Science Committee, dated 2nd April, was submitted and approved.

The Minute stated that a letter had been submitted from the President of the National Veterinary Medical Association, forwarding Section 1 of a Report on the Diseases of Farm Live Stock, and copy of a relative scheme, approved by the Council of that body, for the control of Mastitis, Contagious Abortion, Sterility, and Johne's Disease. The scheme, it was stated, was put forward as a basis of discussion with interested bodies, and the opinions and criticisms of such bodies would be welcomed.

After careful consideration, the Committee had decided to report that they were in favour of a scheme on the general principles laid down, as they fully realised the enormous losses sustained through the diseases named, and any proposals calculated to reduce these losses were deserving of careful consideration. They felt, however, that the scheme must be on a voluntary basis in the first instance, although it would doubtless lead to the introduction of a compulsory scheme when conditions were more favourable.

With regard to the control of Contagious Abortion and Sterility, the Committee felt that the method of blood-testing and segregation is of very limited application, but that the judicious use of vaccines could be greatly extended with advantage. The standardisation of vaccines was regarded as most important.

With regard to the suggested cost to herd-owners, the Committee pointed out that many farmers were at present carrying out what is suggested in the scheme at a much less cost than the figures stated. They considered it to be most desirable that the charges fixed should be such as would attract all classes of stock-owners to come into the scheme.

MEETING OF DIRECTORS, 4TH JUNE 1941.

Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh, in the Chair.

Present.—*Ordinary Directors*—Mr R. Scott Aiton; Mr J. W. Alexander, M.V.O.; Mr David Blair; Major R. F. Brebner; Mr Alexander Clark; Mr James Clark; Mr Peter W. Crawford; Mr Peter Gordon; Mr George Grant; Mr R. Wemyss Honeyman; Mr John Kerr; Mr James R. Lumsden; Mr Finlay MacGillivray; Mr Thomas M'Lay; Mr A. W. Montgomerie; Mr Alexander Murdoch; Mr Robert Park; Mr James Paton; Mr G. H. Russell; Mr Thomas Templeton; Mr T. G. Wilson. *Extraordinary Directors*—Mr William I. Elliot; Mr William Montgomery; Sir Joshua Ross-Taylor; Major Robert W. Sharpe; Mr A. A. Hagart Speirs; Mr James Wither. *Treasurer*—The Earl of Home, K.T. *Honorary Secretary*—Colonel F. J. Carruthers of Dormont.

The late Mr John W. Prentice, Alloa.

Before proceeding with the business of the Meeting, the Chairman referred, with deep regret, to the death of a former member of the Board, Mr John W. Prentice, Longcarse, Alloa.

Mr Prentice, he said, was a member of the Society for nearly thirty years. He joined the Board as an Ordinary Director in November 1927, and was continuously a member from that date up till October 1939.

He took a deep interest in the affairs of the Society, and especially in all matters connected with the Annual Show. Throughout his period of office he took an active part in the work of the Forage Committee, acting as Assistant Steward during the first two years, and as Principal Steward and Convener of the Forage Committee during the remainder of the period. In these capacities he rendered efficient and valuable service to the Society. He was a keen supporter of Alloa as a centre for the Show in 1929, and the success of that Show and of the Show held there in 1937 was in no small measure due to his enthusiasm and energy.

For nearly thirty years Mr Prentice occupied the well-known farm of Craigrie, Clackmannan. He there earned a high reputation for his practical knowledge of arable farming, and, in addition, made a speciality of Dairying and Clydesdale Horse breeding. The herd of British Friesian Cattle which he maintained for many years at Craigrie was widely known and held in high repute.

In addition to his farming enterprises Mr Prentice took a full share in many departments of public work. In all these duties his sound common-sense and outstanding personality, combined with his genial and kindly disposition, rendered him loved and esteemed by all with whom he was associated. His death was a loss to the Society and to Agriculture which they deeply deplored.

A Minute of regret and sympathy was submitted and adopted, the members present upstanding, and the Secretary was instructed to forward a copy to the widow and family of the deceased.

Control of Mastitis, Contagious Abortion, &c.

A letter was submitted from the National Veterinary Medical Association acknowledging letter of 4th April communicating the result of the deliberations of the Society's Science Committee on the Report on Diseases of Farm Live Stock and scheme for the Control of Mastitis, Contagious Abortion, Sterility, and Johne's Disease. The scheme, it was stated, had been referred for consideration to a Joint Committee consisting of members of the National Veterinary Medical Association and of the National Farmers' Union.

Mr T. G. Wilson, Carbeth Home Farm, said he understood a Meeting was to be held in Edinburgh on 10th June, and he suggested that representatives of the Society, if invited, should be present at that Meeting. The suggestion was approved, and Major R. W. Sharpe of The Park, Earlston, and Mr A. W. Montgomerie, Westburn Farm, Cambuslang, were nominated as the Society's representatives.

Scottish Red Cross Agriculture Fund.

The Chairman referred to the Report on the activities of the Scottish Red Cross Agriculture Fund Committee during the year 17th April 1940 to 16th April 1941, copies of which had been circulated to members of the Board. He was sure, he said, they would all be delighted with the result of the year's working. The various Local Committees were being asked to carry on the good work, and to make the total for the coming year even larger than it was in the past year. The only point in the Report to which he wished to call special attention was the fact that the Society had borne the expenses of the Committee, amounting to a sum of £76, 18s. 8d. The cordial thanks of the Red Cross Agriculture Fund Committee were conveyed to the Directors of the Society for defraying these expenses, and for their valuable help and co-operation. (For fuller details, see Report of Half-Yearly General Meeting of 4th June 1941.)

Problems Concerning Live Stock.

The Chairman reported on the proceedings at a Meeting convened by the Department of Agriculture on 14th May, which he had attended as representing the Society. The Meeting was called to consider problems concerning Live Stock which had developed since the outbreak of war. These included the licensing of "rigs," the use of foster-mothers for calves, and the tuberculin testing of cattle, all of which, directly or indirectly, affected the administration of the Department's Live Stock Improvement Scheme.

With regard to the use of foster-mothers for bull calves, which subject was fully discussed at the Meeting, the Shorthorn and Aberdeen-Angus Cattle Societies had since discussed this problem, and he was sure the proposals they were putting forward to the Department would satisfy public opinion on the subject.

The Department's scheme for encouraging, by means of a subsidy, the keeping of cattle on hill grazings was, the Chairman said, also referred to at the Meeting. The scheme was confined to Galloway and Highland Cattle, or crosses of these breeds with a Shorthorn Bull. Criticism was made that other breeds had been unjustly left out of the scheme, and he understood that strong representations were being made to the Department on the subject.

Following the Chairman's report a discussion took place, which was taken part in by Mr G. H. Russell of The Burn; Mr Thomas M. Templeton, Sandyknowe; Mr George Grant of Glenfarclas; Mr Peter Gordon, Balcraig Moor; Mr W. I. Elliot, Middletoun; Mr William Montgomery, North Milton; Mr R. Scott Aiton, Legerwood; and Sir Joshua Ross-Taylor, Mungoswalls.

It was eventually decided that it be left to the Chairman and Secretary to draft a letter informing the Department that the Directors approved of the principle of granting a subsidy for placing breeding cattle on hill grazings. They wished, however, to enter a strong protest against the subsidy being confined to the breeds mentioned in the scheme. They were strongly of opinion that the operation of the scheme should not be limited to any particular breeds of cattle, and they suggested that, in the case of any doubt arising as to the suitability for subsidy of any class of cattle put on a hill, the Department should consult the County Agricultural Executive Committee.

Future of Agriculture.

A Minute of Meeting of the Agricultural Policy Committee, dated 4th June, was submitted and approved.

The Minute stated that the Committee had held a preliminary Meeting that day, when a full discussion took place as to the various aspects of the question which would require to be dealt with, and consideration was given to the most useful lines on which to proceed.

Animal Diseases Research Association.

On the motion of the Earl of Home, K.T., Treasurer, it was unanimously agreed to confirm the proposed grant of £200 for the current year to the Animal Diseases Research Association.

Glasgow Veterinary College.

On the motion of the Earl of Home, K.T., it was unanimously agreed to confirm the proposed grant of £100 for the current year to the Glasgow Veterinary College.

Finance.

A Minute of Meeting of Committee, dated 4th June, was submitted and approved.

The Minute dealt, *inter alia*, with the following matters:—

Edinburgh Highland Reel and Strathspey Society.—It was decided to recommend that the grant of £50 to the Edinburgh Highland Reel and Strathspey Society, together with the additional grant of £25 which was given last year, be renewed for the current year.

War Damage Insurance.—It was decided to recommend Insurance under the Business Scheme of the War Damage Act, 1941, of the following items:—

(1) Office furniture, fittings, printed books, stationery, typewriters, office utensils, &c., within the Society's premises, 8 Eglinton Crescent, Edinburgh —£4500.
(2) Tables used for the Horticultural Exhibit at the Show, stored on the premises of Messrs Mackenzie & Moncur, Ltd., Balcarres Street, Edinburgh— £170.
(3) Showyard material, consisting of sectional buildings, turnstiles, timber, &c., stored on the premises of Messrs Walker & Company, Sawmillers, Shore Street, Inverness—£6600.

The premium payable up till the end of September would be about £175.

Officer and Caretaker.—It was recommended that Mr J. P. Lauder, the Society's Officer and Caretaker, be given a War Bonus of £20 per annum, commencing as from 1st June 1941.

Long Service Gold Medals.—The Secretary had reported that it was found impossible to award Gold Medals under present conditions, and that where Applications for the Gold Medal and Certificate were received, the Certificate had been issued, and the Applicant informed that the Medal could not be awarded until after the War. The Committee recommended that this procedure be approved.

MEETING OF DIRECTORS, 5TH NOVEMBER 1941.

Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh, in the Chair.

Present.—Ordinary Directors—Mr R. Scott Aiton; Major R. F. Brebner; Mr Alexander Clark; Mr Peter Gordon; Mr George Grant; Mr James Hope; Mr A. W. Howison; Mr James R. Lumsden; Mr Finlay MacGillivray; Mr Thomas M'Lay; Mr Alexander Murdoch; Mr Robert Park; Mr James Paton; Captain Ian S. Robertson; Mr G. H. Russell; The Hon. Walter T. H. Scott, Master of Polwarth; Major Robert W. Sharpe; Mr A. A. Hagart Speirs; Mr Thomas Templeton; Mr James Wyllie. *Extraordinary Directors*—Mr Alexander Cormack; Mr William I. Elliot; Mr J. E. Kerr; Mr William Montgomery; Sir Joshua Ross-Taylor; Major Sir Samuel Strang Steel, Bt. *Treasurer*—The Earl of Home, K.T. *Honorary Secretary*—Colonel F. J. Carruthers of Dormont. *Chemist*—Mr J. F. Tocher, D.Sc., LL.D., F.I.C.

The late Brigadier The Hon. Evan Baillie, M.C., T.D.

Before proceeding with the business of the Meeting, the Chairman referred, with deep regret, to the death, two days after their last Meeting in June, of Brigadier The Hon. Evan Baillie, M.C., T.D., of Dochfour. Brigadier Baillie, he said, was a Vice-President of the Society on the occasion of the Show at Inverness in 1932, and was again elected a Vice-President in 1939, and filled that office at the time of his death.

In the County of Inverness, and throughout the Highlands generally, Brigadier Evan Baillie was held in the highest esteem. He served with distinction in His Majesty's Forces, and as the holder of many public offices he rendered valuable services to the community. His kindly disposition and attractive personality earned for him the warm regard of all with whom he was associated, and his untimely death was a loss to Inverness-shire, and indeed to the whole of Scotland, which they deeply deplored.

A Minute of regret and sympathy was submitted and adopted, the members present upstanding, and the Secretary was instructed to forward a copy to the widow and family of the deceased.

The late Mr W. P. Gilmour, Balmangan.

The Chairman also referred, with very deep regret, to the death, since their last Meeting, of a former member of the Board, Mr W. P. Gilmour, Balmangan, Kirkcudbright.

In the death of Mr Gilmour, he said, the Society had lost one of its oldest and most staunch supporters. His membership of the Society extended over a period of fifty-five years, during eighteen of which he served as a member of the Board of Directors. He represented the Society on the Scottish Milk Records Association, and he was one of the Scottish representatives on the Agricultural Advisory Committee of the Council of Agriculture for England.

For over half a century Mr Gilmour was a prominent figure in the agricultural and public life of the Stewartry. It could truly be said that he never spared himself in working for the interests of the community. He gave ungrudging service on many public bodies, and his kind and helpful disposition and sound judgment earned for him the esteem and regard of all with whom he came in contact.

A Minute of regret and sympathy was submitted and adopted, the members present upstanding, and the Secretary was instructed to forward a copy to the relatives of the deceased.

Chairman of the Board for 1941-42.

Sir Joshua Ross-Taylor, Mungoswalls, Duns, moved that Major R. F. Brebner, The Leuchold, Dalmeny House, Edinburgh, be re-elected Chairman of the Board of Directors for another year. In doing so, Sir Joshua said that one would hope that Major Brebner, after all the work he had done, would have the opportunity of being in the Chair for one, if not more, of the Shows after the War.

Colonel F. J. Carruthers of Dormont seconded, and the Motion was unanimously carried.

Major Brebner, in agreeing to accept office, thanked the Directors for the honour they had done him.

Scottish Red Cross Agriculture Fund.

The Secretary submitted a Report on the progress of the Fund during the period from 17th April, the close of the first year's activities, up to the date of that meeting.

The Report stated that many Free Gift Sales of Live Stock and other produce were again being held, although the proceeds of only a few of these had yet come to hand. The scheme for encouraging the holding of Victory Garden Shows and Sales had met with gratifying success. Between forty and fifty of these were held during the months of August, September, and October. A sum of £1700 had been received, and as a few returns had yet to come in, it was thought the final figure would be nearly £2000. The Penny-a-Week Scheme of contributions from farm workers had not been widely taken up, and the results up to date were disappointing.

Sir Joshua Ross-Taylor said it was disappointing to hear that the Penny-a-Week Scheme for farm workers had not been extensively taken up. He did not blame the farm servants, but rather the employers, for not asking their staffs if they would agree to this small deduction. He believed if the employers made the suggestion the workers would readily respond.

After some discussion, Mr R. Scott Aiton, Legerwood, Earlston, suggested that the Scottish Branch, British Red Cross Society, be asked to furnish copies of the Society's Audited Accounts, these copies to be distributed to the Conveners of the various Free Gift Sales throughout the country. This was agreed to.

Future of Agriculture.

A Minute of Meeting of the Agricultural Policy Committee, dated 5th November, was submitted and approved.

The Minute stated that the Committee had further considered the remit from the Board to discuss steps to be taken by the Society towards the consideration of post-war agricultural conditions in Scotland. The various aspects of the question were again fully discussed, and the lines on which future consideration should be directed were carefully considered.

'*Transactions.*'

A Minute of Meeting of Publications Committee, dated 5th November, was read and approved.

The Committee recommended that a volume of 'Transactions,' in a restricted form, be again issued in 1942, provided the printers were able to secure a licence for the necessary paper from the Paper Control.

Control of Animal Diseases.

The Secretary said that an invitation to a Conference on the Control of Animal Diseases, convened by the National Farmers' Union and Chamber of Agriculture of Scotland, came before the June Meeting, when Major R. W. Sharpe and Mr A. W. Montgomerie were nominated as the Society's representatives. The Conference was held on 10th June. The following Note regarding the proceedings at the Conference had been supplied by Miss A. Maclaren, the Secretary of the Union and Chamber :—

"The Conference considered the scheme promoted by the National Veterinary Medical Association for the control of animal diseases—particularly Mastitis, Sterility, Contagious Abortion, and Johne's Disease. After a lengthy discussion, the Producers' representatives came to the conclusion that, while such a scheme was necessary in the national interest as well as in the interest of individuals, the scale of rates proposed for the services of the Veterinary Practitioners was such as to make it unacceptable in Scotland. The delegates of the National Veterinary Medical Association could hold out no hope of introducing a separate scale of charges to apply to Scotland as distinct from England, but they undertook to reconsider the position, and to communicate their decisions at a later stage."

Major R. W. Sharpe of The Park, Earlston, said that the decision of the Conference was similar to that arrived at by the Society's Science Committee. That Committee considered that the rate would require to be radically reduced if the scheme were to be a success.

Hill Sheep Position.

The Chairman reported that, along with Sir Joshua Ross-Taylor, Mr James R Lumsden, and Mr James Paton, he had attended a Conference called by th National Farmers' Union and Chamber of Agriculture of Scotland on 5t September, at which were present representatives of the various bodies intereste in the Sheep and Wool position. The Meeting came to the conclusion that th season was too far advanced to press for further consideration of the prices offere for light-weight mutton and wool, and the only course was to press for a subsid of an adequate amount.

A Sub-Committee was appointed, representative of the Union and Chamber the Highland Society, the Blackface and Cheviot Breed Societies, and the Norther Pastoral Club, with a view to obtaining full information and deciding on the line of the representations to be made to the Secretary of State for Scotland.

The Chairman then indicated the considerations they had taken into accoun in arriving at a figure. He did not think he was at liberty to state what the figur was, as it had not been made public, but they thought it was a reasonable figure The suggestion of a casualty subsidy was turned down, because breeders felt tha it was an ordinary trading risk that should be borne by the owner of the stock The matter was now being considered by the Department of Agriculture an the Secretary of State for Scotland.

Cattle on Hill Grazings.

The Secretary read correspondence which had passed between the Societ and the Department of Agriculture for Scotland with regard to the Subsid Scheme for Cattle on Hill Grazings. In a letter, dated 16th June, the Departmen stated that the object of the scheme was to encourage the stocking of hill grazing with cattle, as a measure primarily designed for the improvement of the lan and so of the general position of the hill farming industry. With this objec in view, and after full consultation with their Advisory Council, the Departmen had come to the decision that certain types of animal were more useful tha others for the purpose, and accordingly they regretted they saw no sufficien reason for extending the scheme to include other breeds of cattle.

In reply, it was pointed out that the Directors fully realised that the objec of the scheme was to encourage the stocking of hill grazings with cattle as measure designed for the improvement of grazings on such hills. What th Directors could not understand was that encouragement should be given t particular breeds of cattle, or their crosses, when other breeds of cattle and thei crosses were equally suitable to promote the objects of the scheme.

In a letter, dated 7th July, the Department stated that the matter had aga been reviewed by the Agricultural Advisory Council. After full consideratio of all the facts at their disposal, the Council were of the opinion that, as othe breeds of cattle were not generally suitable for the essential purpose for whic the scheme was designed, it would be inexpedient to alter its terms as alread announced. Accordingly the Department regretted that, in the meantime, the were not prepared to consider the advisability of extending the scheme to includ other breeds of cattle.

Some discussion followed the reading of this correspondence, but no furthe action was proposed.

Wart Disease of Potatoes Order.

Mr James Paton, Kirkness, Glencraig, reported that the Department of Agri culture held a Conference on 31st July, to which representatives of the Societ were invited. Unfortunately neither Mr James Hope nor he were able to attend but they made written representations against certain restrictions on Scottis seed being sent into England. He was glad to say that the Department ha issued a new Order which met their views. He was sure the Order would be o benefit to Scottish growers. Although it was an Emergency Order, he hoped i would be continued in the days of peace.

Tuberculosis (Attested Herds) Scheme, 1938.

A letter was submitted from the Ministry of Agriculture and Fisheries forwarding copy of an amendment to the rules contained in the First and Second Schedule of the Attested Herds Scheme. The amendment had the effect of permitting the use of milk pasteurised by the method known as "high temperature short-time pasteurisation" in the feeding of animals in herds under the Scheme.

Eduardo Bullrich Silver Challenge Cup.

Letters were submitted from the Secretary of the Shorthorn Society containing an offer of the Eduardo Bullrich Silver Challenge Cup presented by Messrs Adolfo Bullrich & Company, of Buenos Aires, for a pair of Shorthorns, one male and one female, of any age, bred by Exhibitor—the Cup to become the absolute property of an exhibitor winning it on three occasions, not necessarily in succession. The Cup was on view on the table at the Meeting.

It was unanimously decided that the offer be accepted, and the Secretary was instructed to express the cordial thanks of the Society to the donors.

Farmers' Income and Excess Profits Tax.

Mr R. Scott Aiton, Legerwood, submitted the following motion: "That the Board of Directors inquire into the basis of assessment of Farm Accounts for Income and Excess Profits Tax with a view to removing the anomalies which at present exist."

In support of the motion, Mr Scott Aiton referred specially to the large expenditure which pastoral farmers had been obliged to incur in the purchase of tillage implements, and to the writing up of the valuation of ewe stocks. He submitted that the present basis of farm taxation was having a prejudicial effect on the agricultural industry of the country.

Mr W. I. Elliot, Middletoun, Stow, seconded.

After a full discussion, the motion was adopted, and the following Committee was appointed: Major R. F. Brebner (Convener), Mr R. Scott Aiton, Mr W. I. Elliot, Mr Peter Gordon, Mr James Hope, Mr James R. Lumsden, Mr Alexander Murdoch, Sir Joshua Ross-Taylor, with the Treasurer and Hon. Secretary, *ex officiis*.

Finance.

A Minute of Meeting of Committee, dated 5th November, was submitted and approved.

The Minute dealt with the following matters:—

Members' Subscriptions.—The Secretary reported that, at that date, the amount received from members in Life Subscriptions exceeded the amount at the corresponding period last year by £322. There was, however, a falling-off in Annual Subscriptions of £206.

Scottish Agricultural Organisation Society.—It was recommended that the grant of £100 to the Scottish Agricultural Organisation Society be again renewed for the year 1942.

MEETING OF DIRECTORS, 7TH JANUARY 1942.

Major R. F. **Brebner**, The Leuchold, Dalmeny House, Edinburgh, in the Chair.

Present.—Ordinary Directors—Mr R. Scott Aiton; Mr J. W. Alexander, M.V.O.; Major R. F. Brebner; Mr Alexander Clark; Mr James Clark; Mr Peter Gordon; Mr George Grant; Mr James Hope; Mr A. W. Howison; Mr John Kerr; Mr James Kilpatrick; Mr James R. Lumsden; Mr Finlay MacGillivray; Mr Thomas M'Lay; Mr Alexander Murdoch; Mr James Paton; Captain Ian S. Robertson; Mr G. H. Russell; Mr T. Mercer Sharp; Major Robert W. Sharpe; Mr A. A. Hagart Speirs. *Extraordinary Directors*—Mr Alexander Cormack; Mr William I. Elliot; Sir Joshua Ross-Taylor; Major Sir Samuel Strang Steel, Bt. *Treasurer*—

The Earl of Home, K.T. *Honorary Secretary*—Colonel F. J. Carruthers of Dormont. *Auditor*—Mr George James Gregor, C.A.

The late Earl of Southesk.

Before proceeding with the business of the Meeting, the Chairman referred, with deep regret, to the death of a former Vice-President of the Society, the Earl of Southesk, Kinnaird Castle, Brechin. The late Earl was a member of the Society for forty-six years, and filled the office of Vice-President on two occasions—in 1908 and 1928.

Lord Southesk, he said, was deeply interested in everything connected with agriculture, especially in the County of Angus. His estates and historic home received much of his personal attention, but, in addition, he filled many public offices, and devoted much time and interest to the welfare and support of social institutions in the surrounding districts. He was a regular exhibitor of Highland Cattle at the Society's Annual Shows. Through his death the Society had lost a loyal supporter, and the County of Angus a popular and esteemed landowner.

A Minute of regret and sympathy was submitted and adopted, the members present upstanding, and the Secretary was instructed to forward a copy to the Countess of Southesk and family of the deceased.

The late Mr William C. Hunter of Arngask.

The Chairman also referred, with very deep regret, to the death of a valued colleague and former member of the Board, Mr William C. Hunter of Arngask. Mr Hunter was a member of the Society for nearly forty years. He joined the Board as a Director in 1925, and served in that capacity till 1933. Since that date he had continued to give valuable service to the Society as a member of the Finance and Law Committee.

Mr Hunter, the Chairman said, was not only one of the best-known members of the legal profession in Edinburgh, but was widely known amongst agriculturists throughout Scotland as a breeder and exhibitor of Shorthorn Cattle. He built up a select herd of pedigree Shorthorns at Arngask, and his skill as a breeder and knowledge of the breed received recognition by his appointment as President of the Shorthorn Society.

As a member of that Board Mr Hunter rendered notable service to the Society. He was a member of practically all the Standing Committees, and at one time acted as Convener of the Science Committee. His greatest service, however, was in connection with the Finance and Law Committee, where his business capacity and sound judgment were of the greatest value. This fact was recognised by his re-election as a member of that Committee for many years after he had ceased to be a Director.

As a man Mr Hunter was endowed with a kindliness and courtesy, combined with a sense of quiet humour, which endeared him to all with whom he was associated, and his death was a loss to the Society and to Agriculture which they deeply deplored.

A Minute of regret and sympathy was submitted and adopted, the members present upstanding, and the Secretary was instructed to forward a copy to the widow and family of the deceased.

The late Mr Thomas Templeton, Sandyknowe.

The Chairman further referred, with sincere regret, to the death of an esteemed colleague and member of the Board, Mr Thomas Templeton, Sandyknowe. Mr Templeton was a member of the Society for nearly thirty years. He joined the Board of Directors in 1928, and was a Director continuously from that time up to the date of his death.

For over forty years Mr Templeton, in association with his brother Matthew, occupied the well-known Border farm of Sandyknowe, the name of which had become famous through their achievement as breeders of pedigree stock.

Mr Thomas Templeton, he said, must be regarded as probably the greatest stocksman and breeder of pedigree animals of their generation. His great skill as a breeder was displayed in connection with several breeds, including more especially Clydesdale Horses, Border Leicester Sheep, and Aberdeen-Angus Cattle. His oft-repeated dictum was that you must select young, not necessarily expensive, females of the best breeding lines, and that for the sire there must be no hesitation in the price paid for the right animal when selected. This was amply borne out in his purchase of the Clydesdale Stallion "Benefactor" at the price of £4400. That sire and his progeny won for Sandyknowe everything worth winning in the Clydesdale world.

At this Society's Show at Kelso in 1926 stock from Sandyknowe established an outstanding record, being successful in securing no fewer than four Championships—for male and female Clydesdales, for Border Leicester Sheep, and for Oxford Down Sheep.

Mr Templeton was regular in his attendance at the meetings of the Board, and took the keenest interest in the affairs of the Society. While never forward in stating his views, he held decided opinions, and was ever ready to draw upon his comprehensive knowledge of agricultural affairs and give fearless expression to his opinion on the subject under consideration. This, and his quiet and unassuming manner, rendered him to be greatly esteemed by all with whom he was associated, and to them and to the whole agricultural community his passing was mourned as a very great loss.

A Minute of regret and sympathy was submitted and adopted, the members present upstanding, and the Secretary was instructed to forward a copy to the widow of the deceased.

Scottish Red Cross Agriculture Fund.

A report on the progress of the Fund during its second year was submitted by the Secretary. The terms of this report will be found in the Report of Proceedings at the Annual General Meeting held on this date.

Inspection of Growing Crops of Potatoes.

A letter from the Department of Agriculture for Scotland, dated 16th December, was read, containing an invitation to the Society to appoint representatives to attend a Meeting at St Andrew's House on Thursday, 15th January, at 2.30 P.M.

It was decided to nominate the following as the Society's representatives at the Meeting: Mr James Paton, Kirkness, Glencraig, and Mr James Hope, Eastbarns, Dunbar.

Wart Disease of Potatoes.

A letter was read from the Department of Agriculture for Scotland with regard to the export to England and Wales of seed potatoes grown on land which had been scheduled as infected with wart disease. The Department stated that, in view of the terms of the General Licence issued by the Ministry of Agriculture and Fisheries, they would be prepared to consider applications for the issue of licences authorising the export to England and Wales of seed potatoes grown on scheduled land, provided that the crops from which the seed was taken had been inspected under the Department's Scheme for the Inspection of Growing Crops of Potatoes, and certified T.S. (A.) or T.S. (H.). Attention was, however, drawn to the fact that the sale for planting in Scotland of seed taken from crops grown on scheduled land would, as hitherto, be under licence granted by the Department, and that the issue of such licence was conditional on the use of the seed for planting on other scheduled land or in private gardens and allotments.

Scottish Agricultural Organisation Society.

On the motion of the Earl of Home, K.T., Treasurer, it was unanimously agreed to confirm the proposed grant of £100 to the Scottish Agricultural Organisation Society for the year 1942.

Farmers' Income and Excess Profits Tax.

The Secretary reported that the Special Committee met on 5th December, when a full discussion took place on the points raised by Mr Scott Aiton. A Note regarding these points, prepared by Mr Scott Aiton, had been circulated to the members of the Committee in advance.

As a result of the discussion, various points of apparent difficulty and anomaly were cleared up or eliminated. Two points remained which appeared to call for further consideration by the Committee:—

(1) That in cases where a farmer had always been assessed under Schedule D

(and whose annual valuation had varied in accordance with market prices), a fixed valuation should be accepted by the Income Tax Authorities as at the date of the coming into force of the Finance Act, 1941.

(2) That part of the Excess Profits Tax now being levied, and which represented capital taken from the soil, should be set aside to form a reserve fund to make good, after the war, the loss of fertility and deterioration of the soil caused through war-time cropping.

It was resolved to hold another Meeting of the Committee in the month of January.

Hill Sheep Farming Enquiry.

A letter, dated 19th December, was submitted from the Secretary of the Committee, under Lord Balfour of Burleigh's Chairmanship, which had been constituted by the Secretary of State for Scotland to investigate the present position of hill and upland sheep farming in Scotland. The letter stated that the Committee desired to obtain evidence and views from bodies interested, and invited the Society to nominate representatives to submit evidence.

It was agreed that this be done, and the following were nominated :—

Borders—Mr William I. Elliot, Middletoun, Stow.

Perthshire—Mr A. W. Howison of Lochbank, Blairgowrie.

Northern Counties—Major Gideon C. Rutherford, Proncy, Dornoch, Sutherland.

Argyllshire—It was left to the Chairman and Secretary to make inquiries and put forward the name of a suitable representative. (The representative subsequently appointed was Mr J. A. Fletcher, Laudale, Ardgour.)

Sprouting of Ware Potatoes in Pits.

A letter was read from Mr John O. Gordon, Farmer and Seed Potato Grower, Balmuchy, Fearn, Ross-shire, with regard to the loss incurred through the sprouting of ware potatoes in pits. Such potatoes, when kept in pits till May or June, developed a great deal of sprouting, which made dressing more difficult and costly and involved considerable wastage. He suggested that some form of powdered dressing might be devised to check the sprouting, and asked the Society to bring the matter before the Agricultural Colleges and Research Institutes.

After some discussion, it was decided that the letter be transmitted to the Director of the Scottish Society for Research in Plant-Breeding.

Panel of Arbiters.

A letter was read from the Department of Agriculture for Scotland, dated 30th December, forwarding copy of the Panel of Arbiters constituted under Section 17 of the Agricultural Holdings (Scotland) Act, 1923, and inviting the Society to submit, for the Department's consideration, the names and qualifications of any gentlemen whom they regarded as suitable for appointment to the Panel.

The names of several gentlemen were submitted and approved, and the Secretary was instructed to communicate these to the Department of Agriculture.

PROCEEDINGS AT GENERAL MEETINGS.

GENERAL MEETING, 4TH JUNE 1941.

THE EARL OF HOME, K.T., Treasurer of the Society, in the Chair.

New Members.

The Secretary submitted a list of six candidates for election to membership. These were balloted for and admitted members of the Society.

Election of Office-Bearers.

Major R. F. Brebner, Chairman of Directors, moved that the following be elected office-bearers of the Society for the year 1941-42 :—

President.—The Duke of Portland, K.G., P.C., G.C.V.O., Langwell, Berriedale, Caithness.

Vice-Presidents.—The Duke of Sutherland, K.T., P.C., Dunrobin Castle, Golspie; The Earl of Leven and Melville, K.T., Glenferness House, Nairn; Sir Donald W. Cameron of Lochiel, K.T., Achnacarry, Spean Bridge, Inverness-shire; Brigadier the Hon. Evan Baillie, M.C., of Dochfour, Ballindarroch, Scaniport, Inverness.

Ordinary Directors, 1938.—Mr James Clark, Windlaw House, Carmunnock, Glasgow; Mr James Durno, Crichie, Inverurie; Mr R. Scott Aiton, M.C., Legerwood, Earlston; Mr T. G. Wilson, Carbeth Home Farm, Balfron Station; Mr J. W. Alexander, M.V.O., of Newton, Golfhill, Moffat; Mr Robert Park, Brunstane, Portobello, Midlothian; Mr Finlay MacGillivray of Aldie, Tain; Mr David Blair, Littleinch, Wormit, Fife.

1939.—Mr George Grant of Glenfarclas, Blacksboat; The Hon. Walter T. H. Scott, Master of Polwarth, Harden, Hawick; Mr Thomas M'Lay, Dunvegan, Causewayhead, Stirling; Mr Peter Gordon, Balcraig Moor, Port William; Mr James Hope, Eastbarns, Dunbar; Captain Ian S. Robertson, Linkwood, Elgin; Mr Alexander Clark, Strathore House, Thornton; Mr James Kilpatrick, Craigie Mains, Kilmarnock.

1940.—Mr Thomas Templeton, Sandyknowe, Kelso; Mr James R. Lumsden of Arden, Dumbartonshire; Mr J. Faed Sproat, Boreland of Anwoth, Gatehouse, Castle Douglas; Major R. F. Brebner, The Leuchold, Dalmeny House, Edinburgh; Major A. D. Campbell, Stanstill, Wick; Mr James Paton, Kirkness, Glencraig; Mr Alexander Murdoch, East Hallside, Cambuslang, Lanarkshire; Mr G. H. Russell of The Burn, Glenesk, Brechin.

1941.—Mr T. Mercer Sharp, Bardrill, Blackford; Mr James Wyllie, Beaumont, Victoria Road, Dumfries; Mr John Kerr, Yorkston, Gorebridge, Midlothian; Mr A. W. Howison of Lochbank, Blairgowrie; Mr A. A. Hagart Speirs of Elderslie, Houston House, Renfrewshire; Mr John P. Sleigh of St John's Wells, Fyvie; Major R. W. Sharpe of The Park, Earlston.

Extraordinary Directors.—Mr William I. Elliot, Middletoun, Stow; Mr J. E. Kerr of Harviestoun, Dollar; Mr William Montgomery, North Milton, Kirkcudbright; Sir Joshua Ross-Taylor, Mungoswalls, Duns; Mr Francis W. Walker of Leys, Leys Castle, Inverness; Mr Ian M. Campbell, Bal Blair, Invershin; Mr Alexander Cormack (John Wallace & Sons, Ltd.), Sealladh-Mohr, Killearn; Mr Peter W. Crawford, Dryfeholm, Lockerbie; Mr A. W. Montgomerie, Westburn

Farm, Cambuslang, Lanarkshire; Major Sir Samuel Strang Steel of Philiphaugh, Bt., Selkirk.

Treasurer.—The Earl of Home, K.T., The Hirsel, Coldstream.

Honorary Secretary.—Colonel F. J. Carruthers of Dormont, Lockerbie.

Major Brebner, in submitting the list, made sympathetic reference to the untimely death of Mr Duncan A. MacLennan, Balmachree, Inverness, whose name should have appeared on the list of Ordinary Directors. His death was the result of an attack by a bull. He was sure they all learned with deep regret of his death, as they had looked forward to his joining the Board.

Mr James R. Lumsden of Arden seconded the motion, and the office-bearers were duly elected.

Special Grants.

The Earl of Home, K.T., as Treasurer of the Society, moved approval of the following Special Grants, which were recommended by the Board of Directors:—

(1) £200, for the current year, to the Animal Diseases Research Association.
(2) £100, for the current year, to the Glasgow Veterinary College.
(3) £50, for the current year, to the Edinburgh Highland Reel and Strathspey Society, plus £25 extra war contribution.

Mr Alexander Murdoch, East Hallside, Cambuslang, in seconding the motion, said that, as the Society's representative to the Glasgow Veterinary College and as Chairman of the Governors of the College, he would like to report that, through the generosity of a Governor, a complete history of the College by a well-known agricultural journalist had been prepared. A copy would be sent to the Society to be placed in its Library.

The Special Grants were duly approved.

Scottish Red Cross Agriculture Fund.

Major R. F. Brebner submitted a report on the activities of the Fund. At the Anniversary General Meeting in January, he said, it was reported that the total amount received by the Scottish Red Cross Agriculture Fund, at that date, amounted to £82,176, 12s. 6d.

At the conclusion of the first year of operations of the Committee of the Fund, on 16th April 1941, it was found that the total contributions received during the year amounted to £115,811, 9s. 4d. To this was added a sum of £65, 4s. 10d., being interest accrued on certain sums placed on Deposit Receipt for short periods. That gave a grand total for the year of £115,876, 14s. 2d.

The whole of the money raised had been handed over to the Scottish Branch, British Red Cross Society, and the St Andrew's Ambulance Association. The amount allocated to the former body was £92,461, 7s. 4d., and to the latter, £23,415, 6s. 10d.—in all £115,876, 14s. 2d. It would thus be seen that every penny received by the Committee, plus Deposit Receipt interest, had been handed over to the benefiting charities, no deduction whatever being made for expenses. The expenses, which amounted to a sum of £76, 18s. 8d., mainly for postages, printing, stationery, &c., were met by the Highland and Agricultural Society, which also provided the staff, office accommodation, telephone service, &c., free of charge.

At a Meeting of the General Committee of the Fund, held on 7th May, cordial resolutions of thanks were passed to all those bodies and individuals who had contributed so effectively to the remarkable success of the Fund. A cordial vote of thanks was accorded to the Directors and Members of the Highland and Agricultural Society for the valuable help which the Society had given to the movement.

During the coming year, he said, he hoped that the Free Gift Sales, which had contributed so handsomely to the Fund during the past year, would be continued and possibly extended to new areas. Other main lines of activity included the encouragement of Horticultural, Garden, and Allotment Societies to hold Shows of Garden Produce on behalf of the Fund, and a Scheme, originally put forward by the Scottish Farm Servants' Union, whereby farm workers were given an opportunity of contributing to the Fund.

Major Brebner added that he wished to emphasise the necessity for continuing this work on behalf of the Scottish Red Cross Society and the St Andrew's

Ambulance Association. He was afraid that from now on they would probably be involved in much more serious conflict than there had been up to date. They must make an appeal to all the farming interests to do everything they could to promote those Sales and also local Horticultural Shows, so that they might be able to again raise from Agriculture as handsome a total as they did last year. He would also like to commend to farmers the efforts of the Scottish Farm Servants' Union and to ask them to give their workers the opportunity to make the penny-a-week contributions towards the Fund.

The Chairman said he would like to support the appeal for continued efforts made by Major Brebner. They earnestly hoped that a larger result would be achieved than last year, which was very good.

The report was approved.

Future of Agriculture.

Major Brebner also submitted a report on post-war agriculture:—

At the Anniversary General Meeting in January, he said, Mr W. J. Campbell, Edinburgh, suggested that the Directors give consideration to the matter of post-war agricultural conditions in Scotland. Mr Campbell thought the Directors should consider the formation of a body to begin without delay the planning of a post-war agriculture.

At that Meeting he had said in reply, as Chairman, that the matter had been discussed at a Meeting of Directors held earlier that day. He was not in a position to say what would be done, but, personally, he thought they would probably appoint a small Committee to consider how best they could set about tackling this very big question.

At a subsequent Meeting of Directors, on 2nd April, he had moved "that a Committee be appointed to discuss what steps should be taken by the Society towards the consideration of post-war agricultural conditions in Scotland." In submitting that motion, he said that one of the main points to be considered was the question of stable prices for the produce of the soil. That was something they had never had in the past, and he felt they could never have a prosperous agriculture unless they could have stable conditions in the industry. Another main point was the question of capital—capital to equip a farm with the necessary buildings, fencing and drainage, and capital to stock it properly. Where that capital was to come from would be one of the chief questions to be dealt with in any consideration of post-war conditions. Conditions of housing must also be considered, as the land had to be made attractive for the worker to reside on. That was one of the things that had been neglected in the past.

That motion had been unanimously adopted and a Committee appointed.

Major Brebner said he had nothing further to add except to say that at a Meeting of the Committee held that morning they had a fairly long discussion on the subject, and they came to certain conclusions which, he hoped, might lead to something concrete in the near future. The Committee were continuing their efforts to explore the question.

The report was approved.

Excess Profits Tax.

Major Brebner further submitted the following report:—

At the Anniversary General Meeting in January Mr W. J. Campbell also directed attention to the 100 per cent Excess Profits Tax, which, he said, would militate against extra production. Mr Campbell suggested the formation of a Committee to consider the whole question of Agricultural Taxation.

At the Meeting of Directors held on 2nd April, it was decided that this was a matter outwith the scope of the Society, and that no action be taken on the lines suggested.

The report was adopted.

Agricultural Education.

Colonel F. J. Carruthers of Dormont, Lockerbie, Convener of the Education Committee, submitted the following report on the 43rd Examination for the National Diploma in Agriculture:—

At the Examination held at Leeds from 1st to 8th April 1941, 86 candidates presented themselves, as compared with 129 at the Examinations held in 1940 at Edinburgh and Leeds. 23 candidates were from Scottish centres. As a result of the Examination 31 Diplomas were awarded. Of the 86 candidates, 7 appeared for all subjects, and of these, 5 obtained the Diploma. 32 had passed certain subjects previously and were completing the Examination this year, and of these, 26 were successful in obtaining the Diploma. The remaining 47 presented themselves for groups of three, four, or five subjects, and of these, 30 passed in the subjects for which they appeared and were entitled to appear for the second group of subjects at a subsequent Examination.

Science.

Report by Chemist.

In the absence through indisposition of Dr J. F. Tocher, Consulting Chemist to the Society, Mr James Paton, Kirkness, Glencraig, submitted a report on the work done in the Chemical Department during the past six months. The substance of the report appears on pp. 162-168 of this volume.

Vote of Thanks.

Sir Joshua Ross-Taylor, Mungoswalls, Duns, in moving a vote of thanks to the Earl of Home for presiding, said that it was well they should have such a man in Scotland as his lordship. Not only this Society, but also many other public bodies were extremely indebted to Lord Home for his many activities on their behalf. He need not remind them of the amount of work done and the good advice given by Lord Home as Treasurer of the Society. He attended the Meetings with great regularity and was always ready with the appropriate advice at the appropriate moment.

ANNIVERSARY GENERAL MEETING, 7TH JANUARY 1942.

THE EARL OF HOME, K.T., Treasurer of the Society, in the Chair.

New Members.

The Secretary submitted a list of five candidates for election to membership. These were balloted for and duly elected.

Membership.

Major R. F. Brebner, Chairman of Directors, reported that the membership of the Society at the beginning of 1941 was 9346. During that year there were lost, through death, resignation, and other causes, 358 members. New members elected during the year numbered 9, thus making the total membership 8997.

Of that number 5512 were Life Members and 3485 annual subscribers—332 on the higher and 3153 on the lower rate. 56 members of the Society had intimated that they were on service with H.M. Forces, and these, in accordance with a resolution of the Directors, would continue to receive the privileges of membership without payment of subscriptions, throughout the duration of the war.

Finance.

The Earl of Home, K.T., Treasurer of the Society, submitted the Accounts of the Society for the year ending 30th November 1941.

In order to economise in paper and save expense, the Abstract of Accounts had not been issued to each member as in pre-war years. A short Abstract, however, had been published in various newspapers, as laid down in the bye-laws.

Owing to increased market values of securities, the Society's investments had appreciated in value during the year to the extent of some £10,000.

Revenue for the year from all sources amounted to £8464, 3s. 8d., and expenditure to £7546, 7s. 7d. The income from annual subscriptions was £1690, 13s. 6d., and from life subscriptions £847, 7s.

During the year under review the expenditure on Educational work amounted to £267, 4s. 6d.; on work in the Chemical and Veterinary Departments, £286, 2s. 3d.; on the Society's 'Transactions,' £1149, 10s. 5d.; and in grants to Local Societies for the year 1940, £388, 9s. 4d.

Special Grants had been made during the year as follows: Animal Diseases Research Association, £200; Glasgow Veterinary College, £100; Scottish Agricultural Organisation Society, £100; Scottish Red Cross Agriculture Fund, £76, 18s. 8d.; other Grants, £87, 2s.—a total of £564, 0s. 8d.

It would be observed from the view of receipts and payments that, excluding the income from life subscriptions, which should be regarded as a capital receipt, the Accounts brought out a surplus of £70 for the year.

Thereafter Lord Home moved approval of the following Special Grants, which had been recommended by the Board of Directors:—

(1) £100 to the Scottish Agricultural Organisation Society for the year 1942.
(2) £10 to the Scottish Society for the Prevention of Cruelty to Animals.

Mr Alexander Murdoch, East Hallside, Cambuslang, in seconding, said Lord Home had gone into the details so thoroughly that it was unnecessary on his part to add very much to what his Lordship had said. The only observation he would like to make was that a good part of the establishment expenses could be considered as having been incurred in connection with the Scottish Red Cross Agriculture Fund, and he had no doubt the Society would get due credit for the work done in that respect.

The Accounts were then adopted and the Special Grants unanimously approved.

Argyll Naval Fund.

Mr James R. Lumsden of Arden, Dumbartonshire, submitted the report on the Fund for the year ended 30th November 1941. The income from the Fund for the year amounted to £320, 2s. 2d., while the expenditure comprised grants of £40 each to eight naval cadets—a total of £320.

Scottish Red Cross Agriculture Fund.

A report on the Fund was submitted by the Secretary. During the period from 17th April 1941, the beginning of the second year's activities, up to the date of that meeting, a sum of £62,318, 13s. 5d. had been received by the Committee. Adding that sum to the amount raised during the first year, £115,876, 14s. 2d., gave a grand total of £178,195, 7s. 7d. contributed by Agriculture to the benevolent work of the Red Cross during a period of twenty months.

Free Gift Sales.—The proceeds of twenty-seven Free Gift Sales had so far been received, and these realised a sum of £57,067, 11s. 7d. The proceeds of approximately a similar number of sales had yet to come to hand. It had been a gratifying feature, he said, that, in the majority of cases, the sales held in 1941 had shown an increase in drawings compared with 1940, and in some cases a substantial increase. The unfortunate feature was that the number of sales held was less by about a dozen, due to the fact that the Committees at some centres, where large sums had been raised in 1940, had felt that the effort could not be renewed until after an interval of two years. That falling off, however, might be partly offset by sales held at a few new centres—notably in Aberdeenshire and Morayshire. It was feared, however, that the total to be realised during the second year of the Committee's activities could not possibly reach the figure achieved during the first year.

Of the returns received some outstanding results required to be specially mentioned. Perth had set up a new high record of £5278, 19s. 11d., being an increase of £477, 16s. 3d. over the previous year's figure. Other notable contributions were: Lanark, £3634, 1s. 8d.; Blairgowrie, £3402, an increase of £1274, 9s. 8d. over the previous figure; Haddington, £2785, 2s. 2d.; Peebles, £2765, 12s., an increase of £1410, 8s. 3d., or more than double the 1940 figure; Kelso, £2725, 9s. 3d.; Cupar, £2678, 8s. 3d., an increase of £671, 0s. 4d.; Dundee, £2488, 2s., an increase of £484, 19s.; Laurencekirk, £2419, 11s. 6d., an increase of £373, 11s. 6d.; St Boswells, £2300; Inverurie, £2150, an increase of £150; Dunfermline, £2056, 8s. 7d., an increase of £285, 13s. 11d.; Crieff, £2000.

Victory Garden Shows.—The new scheme for encouraging the holding of Victory Garden Shows and Sales had met with gratifying success. Between forty and fifty of these Shows and Sales of Garden Produce had been held during the months of August, September, and October 1941. In order to encourage Horticultural and Allotment Associations to hold such Shows and Sales the Committee had offered them a supply of Advertising Posters, Exhibitors' Cards, Prize Labels, and Merit Certificates. Those Societies and Associations which had decided to organise such functions entered into the scheme with the greatest enthusiasm, and in practically every case the sums raised were stated to have exceeded the amounts accruing from Shows held prior to the war. Other Societies which could not see their way to organise a Show sent a donation to the funds. The amount received as a result of these Victory Garden Shows and Sales, up to date, totalled £1907, 13s. 1d., and a few returns had yet to come in.

Farm Workers' Contributions.—The Scheme for Penny-a-Week contributions from farm workers was disappointing at the commencement, but recently there had been indications of a growing interest in the movement, and since November some substantial sums had been received. The total so far received amounted to £158, 7s. 3d.

Miscellaneous.—From various other sources a sum of £3185, 1s. 6d. had been contributed to the fund. Amongst these contributions special mention was made of an anonymous donation by 'A Berwickshire Farmer' of £782, 0s. 4d.; Dumbarton County War Benevolent Fund, £500; Aberdeen and District Milk Marketing Board, £419, 14s. 6d.; 'Racing Pigeon,' Scottish patrons of the Sport, £176, 16s. Numerous smaller sums had been received from, amongst others, Young Farmers' Clubs, Breed Societies, and Agricultural College Staffs.

Letter from the Duke of Gloucester.—In December 1941 a letter had been received from H.R.H. The Duke of Gloucester, President of the Red Cross and St John Fund in England, expressing pleasure at learning of the splendid support given by the Scottish Red Cross Agriculture Fund to the Scottish Branch, British Red Cross Society, and to the St Andrew's Ambulance Association. That could not have been achieved, the letter stated, without the whole-hearted co-operation of all the agricultural interests throughout Scotland. His Royal Highness conveyed to the Committee his congratulations and appreciation of the fine results of their efforts.

A facsimile copy of this letter had been forwarded to each member of the Committee and to the Conveners and Secretaries of all Area Committees.

Lord Home, the Chairman, said that the report was a most satisfactory and encouraging one, and he knew that all their thanks were heartily given to the auctioneers and to all the kind people who had helped to make the Fund the enormous success it was. On the whole it had been a splendid effort, and he would like again to thank Mr Stirton, who had worked hard on behalf of the Fund. They were all satisfied with the report.

Grants to Local Societies.

Mr James Paton, Kirkness, Glencraig, Vice-Convener of the Shows Committee, in introducing the report, said that a year ago the Directors had decided that all grants by the Society of money or medals in aid of local Agricultural Shows or Competitions be suspended for the further duration of the war. In the main, therefore, the grants made by the Society in 1941 were concerned with Horse-Breeding Associations in Scotland, and a total sum of £285 had been expended during that year in respect of Horse-Breeding grants. Special grants, and Ploughing, Hoeing, and Long Service Awards, amounted to £143, 1s. 7d.—making a total expenditure of £428, 1s. 7d. during the year.

The issue of Long Service Gold Medals had been temporarily suspended during the war, but applicants would be entitled, in the meantime, to the appropriate Certificate, and could claim the Gold Medals when these become available.

For the year 1942 the Directors had authorised the following grants: fourteen Horse-Breeding Associations for grants of £15 each in respect of Stallions engaged; £15 and fifteen Silver Medals to the Scottish National Union of Allotment Holders for Allotments Competitions; grants to Federations of Scottish Women's Rural Institutes; Long Service Awards and other special grants—the total estimated expenditure in 1942 for all grants being £406, 9s.

National Diploma in Dairying.

Colonel F. J. Carruthers of Dormont, Convener of the Education Committee, submitted the following Report on the Examination held in 1941:—

The Forty-sixth Annual Examination for the National Diploma in Dairying took place during September at the Dairy School for Scotland, Auchincruive, Ayr, for Scottish students, and at the University and British Dairy Institute, Reading, for English and Welsh students.

At the Auchincruive centre, 30 candidates presented themselves—a number again below the average of recent years. 23 candidates appeared for all subjects, and 7 for re-examination in certain subjects in which they had previously failed. 18 candidates obtained the Diploma.

At the Reading centre, 44 candidates presented themselves—30 candidates for all subjects, 13 for re-examination in certain subjects, and 1 for Part I. of the Examination. 24 candidates obtained the Diploma.

Of those candidates who failed, 6 at Auchincruive and 11 at Reading failed in not more than three subjects, and these will be permitted to reappear for the subjects in which they failed at a subsequent Examination.

Report by Chemist.

Dr J. F. Tocher, Consulting Chemist to the Society, submitted a Report on the work done in his department during the past half-year. In Dr Tocher's unavoidable absence, the Report was read by Major R. W. Sharpe, Convener of the Science Committee. The substance of the Report appears on pp. 162-168 of this volume.

Bracken Investigation.—It was intimated on behalf of Dr Tocher that he was now in a position to conduct feeding experiments on live stock using silage made from young bracken. He had also commenced an investigation on mature bracken, undertaken to ascertain whether or not there was a poisonous or injurious substance present which would account for the reputed illnesses supposed to be brought about by cattle eating bracken.

Fertilisers.

Mr William Smith, M.A., B.Sc., Edinburgh, Secretary of the Scottish Fertilisers Distribution Committee, in reference to the subject of fertilisers, said the nitrogenous position was quite satisfactory. He thought there would be ample supplies of sulphate of ammonia, nitro-chalk, and nitrate of soda. Superphosphate would be larger than last year, but as there was a bigger acreage to dress it could not be put on lavishly. Basic slag would be similar to last year—viz., 60,000 tons. That was the Scottish quota. So far as bones were concerned, the supplies were very limited. These came chiefly from India, and it was purely a question of shipping. The position of potash was happier than they had any right to expect. They had enough to cover not only priority crops, but also potash-deficient soils. This meant that all crops grown on potash-deficient soils would have a claim upon potash, provided the executive officers granted a certificate. It was up to farmers who had potash-deficient soils to get in touch with their executive officers immediately and obtain a declaration form. Last year the situation was saved by having a longer spring, but there was no guarantee of that in 1942. If farmers left off until the spring it would be impossible to get the materials out, and many farmers would have to go without. Those who had the accommodation should take their manures now, otherwise many would have to go without.

Vote of Thanks.

On the motion of Mr J. W. Alexander, M.V.O., of Newton, Golfhill, Moffat, a vote of thanks was accorded to the Earl of Home for presiding.

Lord Home, in acknowledging, expressed the hope that they would all have a happier and more peaceful year.

PREMIUM BOOK

OF

THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND

1942

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Address for communications:

JOHN STIRTON, Secretary,
The Highland and Agricultural Society of Scotland,
8 Eglinton Crescent,
Edinburgh 12.

Telephone: 23655. *Telegraphic Address:* "**Society, Edinburgh.**

GENERAL NOTICE.

The Highland Society was instituted in the year 1784, and incorporated by Royal Charter in 1787. Its operation was at first limited to matters connected with the improvement of the Highlands of Scotland; but the supervision of certain departments, proper to that part of the country, having been subsequently committed to special Boards of Management, several of the earlier objects contemplated by the Society were abandoned, while the progress of agriculture led to the adoption of others of a more general character. The exertions of the Society were thus early extended to the whole of Scotland, and have since been continuously directed to the promotion of the science and practice of agriculture in all its branches.

In accordance with this more enlarged sphere of action, the original title of the Society was altered, under a Royal Charter, in 1834, to The Highland and Agricultural Society of Scotland.

The Society avoids questions of political controversy, but in other public matters of practical concern to agriculture it seeks to guard and promote, by every means in its power, the welfare of all interested in the agriculture of Scotland.

Among the more important measures which have been effected by the Society are—

1. Agricultural Meetings and General Shows of Stock, Implements, &c., held in the principal towns of Scotland, at which exhibitors from all parts of Great Britain, Northern Ireland, and Eire (Irish Free State) are allowed to compete.
2. A system of District Shows instituted for the purpose of improving the breeds of Stock most suitable for different parts of the country, and of aiding and directing the efforts of Local Agricultural Societies and Associations.
3. A scheme of Awards to Farm Workers for long and approved service in Scotland.
4. The encouragement of Agricultural Education, under powers conferred by a supplementary Royal Charter, granted in 1856, and authorising the Society to grant Diplomas to Students of Agriculture; and by giving grants in aid of education in Agriculture and allied sciences. In 1900 the Society discontinued its own Examination, and instituted jointly with the Royal Agricultural Society of England an Examination for a National Diploma in Agriculture.
5. The institution of an Examination for a National Diploma in Dairying, jointly with the Royal Agricultural Society of England and the British Dairy Farmers' Association.
6. The institution of an Examination in Forestry for First and Second Class Certificates. Terminated in 1935 in accordance with arrangements made with the Royal Scottish Forestry Society.
7. The advancement of the Veterinary Art, by conferring Certificates on Students who have passed through a prescribed curriculum, and who are found, by public examination, qualified to practise. Terminated in 1881 in accordance with arrangements made with the Royal College of Veterinary Surgeons.
8. The appointment of a Chemist for the purpose of promoting the application of science to agriculture.
9. The establishment of a Botanical Department.
10. The appointment of an Entomologist to advise members regarding insect pests, &c.
11. The annual publication of the 'Transactions,' comprehending papers by selected writers, Prize Reports, and reports of experiments, also an abstract of the business at Board and General Meetings, and other communications.
12. The management of a fund left by John, 5th Duke of Argyll (the original President of the Society), to assist young natives of the Highlands who enter His Majesty's Navy.

CONSTITUTION AND MANAGEMENT.

The general business of The Highland and Agricultural Society of Scotland is conducted under the sanction and control of the Royal Charters, referred to above, which authorise the enactment of Bye-Laws.

The Office-Bearers consist of a President, Four Vice-Presidents, Thirty-two Ordinary and Twenty Extraordinary Directors, a Treasurer, an Honorary and an Acting Secretary, an Auditor, and other Officers.

The Supplementary Charter of 1856 provides for the appointment of a Council on Education, consisting of Sixteen Members—Nine nominated by the Charter and Seven elected by the Society.

STATEMENT OF PRIVILEGES OF MEMBERS.

MEMBERS OF THE SOCIETY ARE ENTITLED—

1. *To receive a free copy of the 'Transactions' annually.*
2. *To apply for District Premiums that may be offered, and for Long Service Awards for Agricultural Employees.*
3. *To report Ploughing Matches for Medals that may be offered.*
4. *To Free Admission to the Shows of the Society.*
5. *To exhibit Live Stock and Implements at reduced rates.*

Firms are not admitted as Members; but if one partner of a firm becomes a Member the firm is allowed to exhibit at Members' rates.

6. *To have Fertilisers and Feeding-Stuffs, &c., analysed at reduced fees.*
7. *To obtain Reports on the Animal Enemies of Crop Plants and Live Stock (including Poultry).*
8. *To attend and vote at General Meetings of the Society.*
9. *To vote for the Election of Directors.*

&c., &c.

ANALYSES OF FERTILISERS AND FEEDING-STUFFS, &c.

The scale of Fees in respect of Analyses made by the Society's Chemist for Members of the Society will be found under "Chemical Department."

Valuations of manures, according to the Society's scale of units, will be supplied on application being made.

For further particulars, see under Chemical Department.

Chemist.—Mr J. F. TOCHER, D.Sc., LL.D., F.I.C., Crown Mansions, 41½ Union Street, Aberdeen.

REPORTS ON THE ANIMAL ENEMIES OF CROP PLANTS AND LIVE STOCK (INCLUDING POULTRY).

The Consulting Zoologist is prepared to send to any Member of the Society a Report on damage to, or diseases of, plants and animals due to animal agency (Insects, Mites, Worms, Snails, Slugs, Birds, and the Smaller Mammals).

For further particulars, see under Entomological Department.

Consulting Zoologist.—Mr A. E. CAMERON, M.A., D.Sc., Department of Agricultural and Forest Zoology, University of Edinburgh, 10 George Square, Edinburgh.

TERMS OF MEMBERSHIP, &c.

The influence and usefulness of the Society depend mainly upon its strength in membership. The Members, through the Directors whom they elect, have the practical control of the affairs of the Society. The stronger the body of Members, the greater will be the usefulness of the Society. It will therefore be to both their own and the public advantage if all who are interested in agriculture, and who are not already enrolled, should at once become Members of the Society.

ELECTION OF MEMBERS.

Candidates for admission to the Society must be proposed by a Member, and are elected at the half-yearly General Meetings in January and June. It is not necessary that the proposer should attend the Meeting.

RATES OF SUBSCRIPTION.

Higher Subscription.

The ordinary annual subscription is £1, 3s. 6d., and the ordinary subscription for life-membership is £12, 12s.; or after ten annual payments have been made, £7, 7s.

Lower Subscription.

Proprietors farming the whole of their own lands, whose rental on the Valuation Roll does not exceed £500 per annum, and all Tenant-Farmers, Secretaries or Treasurers of Local Agricultural Associations, Factors resident on Estates, Land Stewards, Foresters, Agricultural Implement Makers, Grain, Seed and Manure Merchants, Agricultural Auctioneers, Cattle Dealers and Veterinary Surgeons, none of them being also owners of land to an extent exceeding £500 per annum, and such other persons as, in respect of their official or other connection with agriculture, the Board of Directors may consider eligible, are admitted on a subscription of 10s. annually, which may be redeemed by one payment of £7, 7s., and after eight annual payments of 10s. have been made, a Life Subscription may be purchased for £5, 5s., and after twelve such payments, for £3, 3s.

It must be stated, on behalf of Candidates claiming to be admitted at the Lower Rate of Subscription (10s.), under which of the above designations they are entitled to be admitted at the Lower Rate.

Subscriptions are payable on election, and afterwards annually in January.

According to the Charter, a Member who shall not have objected to his election, on the same being intimated to him by the Secretary, cannot retire until he has paid, in annual subscriptions or otherwise, an amount equivalent to a life composition.

Members are requested to send to the Secretary the names and addresses of Candidates proposed for admission to the Society, at the same time stating whether the Candidates should be admitted at the £1, 3s. 6d. or 10s. rate.

Patron of the Society.—HIS MAJESTY THE KING.

OFFICERS AND DIRECTORS FOR 1941-1942.

President.

The Duke of Portland, K.G., P.C., G.C.V.O., Langwell, Berriedale, Caithness.

Vice-Presidents.

The Duke of Sutherland, K.T., P.C., Dunrobin Castle, Golspie.
The Earl of Leven and Melville, K.T., Glenferness House, Nairn.
Sir Donald W. Cameron of Lochiel, K.T., Achnacarry, Spean Bridge, Inverness-shire.

Year of Election.	Ordinary Directors.
1938	James Clark, Windlaw House, Carmunnock, Glasgow.
	James Durno, Crichie, Inverurie.
	R. Scott Aiton, M.C., Legerwood, Earlston.
	T. G. Wilson, Carbeth Home Farm, Balfron Station.
	J. W. Alexander, M.V.O., of Newton, Golfhill, Moffat.
	Robert Park, Brunstane, Portobello, Midlothian.
	Finlay MacGillivray of Aldie, Tain.
	David Blair, Littleinch, Wormit, Fife.
1939	George Grant of Glenfarclas, Blacksboat.
	The Hon. Walter T. H. Scott, Master of Polwarth, Harden, Hawick.
	Thomas M'Lay, Dunvegan, Causewayhead, Stirling.
	Peter Gordon, Balcraig Moor, Port William.
	James Hope, Eastbarns, Dunbar.
	Captain Ian S. Robertson, Linkwood, Elgin.
	Alexander Clark, Strathore House, Thornton, Fife.
	James Kilpatrick, Craigie Mains, Kilmarnock.
1940	Matthew Templeton, Goshen Bank, Kelso (elected 3rd June 1942).
	James R. Lumsden of Arden, Dumbartonshire.
	J. Faed Sproat, Boreland of Anwoth, Gatehouse, Castle Douglas.
	Major R. F. Brebner, The Leuchold, Dalmeny House, Edinburgh.
	Major A. D. Campbell, Stanstill, Wick.
	James Paton, Kirkness, Glencraig.
	Alexander Murdoch, East Hallside, Cambuslang, Lanarkshire.
	G. H. Russell of The Burn, Glenesk, Brechin.
1941	T. Mercer Sharp, Bardrill, Blackford.
	James Wyllie, Beaumont, Victoria Road, Dumfries.
	John Kerr, Yorkston, Gorebridge, Midlothian.
	Ralph S. MacWilliam, Garguston, Muir of Ord, Ross-shire.
	A. W. Howison of Lochbank, Blairgowrie.
	A. A. Hagart Speirs of Elderslie, Houston House, Renfrewshire.
	John P. Sleigh of St John's Wells, Fyvie.
	Major Robert W. Sharpe of The Park, Earlston.

Extraordinary Directors.

Year of Election.	
1940	**William I. Elliot**, Middletoun, Stow, Midlothian.
	J. E. Kerr of Harviestoun, Dollar.
	William Montgomery, North Milton, Kirkcudbright.
	Sir **Joshua Ross-Taylor**, Mungoswalls, Duns.
	Francis W. Walker of Leys, Leys Castle, Inverness.
1941	**Ian M. Campbell**, Bal Blair, Invershin.
	Alexander Cormack (John Wallace & Sons, Ltd.), Sealladh-Mohr, Killearn.
	Peter W. Crawford, Dryfeholm, Lockerbie.
	A. W. Montgomerie, Westburn Farm, Cambuslang, Lanarkshire.
	Major Sir **Samuel Strang Steel** of Philiphaugh, Bt., Selkirk.

Chief Officials, &c.

The Earl of Home, K.T., The Hirsel, Coldstream, *Treasurer*.

Colonel **F. J. Carruthers** of Dormont, Lockerbie, *Honorary Secretary*.

John Stirton, 8 Eglinton Crescent, Edinburgh, *Secretary*.

Thomas W. Russell, *Chief Clerk*.

John Watt, *Second Clerk*.

George James Gregor, C.A., 8 York Place, Edinburgh, *Auditor*.

J. F. Tocher, D.Sc., LL.D., F.I.C., 41½ Union Street, Aberdeen, *Chemist*.

Henry Raeside, 8 Eglinton Crescent, Edinburgh, *Master of Works*.

A. E. Cameron, M.A., D.Sc., University of Edinburgh, 10 George Square, Edinburgh, *Consulting Zoologist*.

The Very Rev. **Charles L. Warr**, D.D., 63 Northumberland Street, Edinburgh, *Chaplain*.

Tods, Murray, & Jamieson, W.S., 66 Queen Street, Edinburgh, *Law Agents*.

William Blackwood & Sons Ltd., 45 George Street, Edinburgh, *Publishers*.

Hamilton & Inches, Princes Street, Edinburgh, *Silversmiths*.

Alexander Kirkwood & Son, 9 St James' Square, Edinburgh, *Medallists*.

John Menzies & Co. Ltd., 6 Castle Street, Edinburgh, *Advertising Agents*.

Frank Reid, 55 Blenheim Place, Aberdeen, *Showyard Erector*.

J. P. Lauder, *Officer and Caretaker*.

Chairman of Board of Directors.

Major **R. F. Brebner**, The Leuchold, Dalmeny House, Edinburgh.

Chairmen of Committees.

1. *Argyll Naval Fund* . .	**MacLachlan of MacLachlan**, Castle Lachlan, Strathlachlan.
2. *Finance, Chambers, and Law*	The **Earl of Home**, K.T., The Hirsel, Coldstream.
3. *Publications* . . .	Colonel **F. J. Carruthers** of Dormont, Lockerbie.
4. *Shows*	**Ian M. Campbell**, Bal Blair, Invershin.
5. *Implements and Machinery* .	Sir **Joshua Ross-Taylor**, Mungoswalls, Duns.
6. *Science*	Major **Robert W. Sharpe** of The Park, Earlston.
7. *General Purposes* . .	Major **R. F. Brebner**, The Leuchold, Dalmeny House, Edinburgh.
8. *Education*	Colonel **F. J. Carruthers** of Dormont, Lockerbie.
9. *Office-Bearers* . . .	Major **R. F. Brebner**, The Leuchold, Dalmeny House, Edinburgh.

COMMITTEES FOR 1941-1942.

1. ARGYLL NAVAL FUND.

MACLACHLAN OF MACLACHLAN, Castle Lachlan, Strathlachlan, *Convener.*
Major A. D. CAMPBELL, Stanstill, Wick.
IAN M. Campbell, Bal Blair, Invershin.
Lieut.-Colonel GARDEN B. DUFF, D.S.O., of Hatton, Hatton Castle, Turriff.
The EARL OF ELGIN AND KINCARDINE, K.T., C.M.G., Broomhall, Dunfermline.
J. E. KERR of Harviestoun, Dollar.
JAMES R. LUMSDEN of Arden, Dumbartonshire.
ALEXANDER MURDOCH, East Hallside, Cambuslang, Lanarkshire.
Sir JOSHUA ROSS-TAYLOR, Mungoswalls, Duns.
Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh, Chairman of Board of Directors, *ex officio.*
The EARL OF HOME, K.T., The Hirsel, Coldstream, Treasurer, *ex officio.*
Colonel F. J. CARRUTHERS of Dormont, Lockerbie, Honorary Secretary, *ex officio.*

2. FINANCE, CHAMBERS, AND LAW.

The EARL OF HOME, K.T., The Hirsel, Coldstream, Treasurer, *Convener.*
Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh.
IAN M. CAMPBELL, Bal Blair, Invershin.
JAMES DURNO, Crichie, Inverurie.
GEORGE GRANT of Glenfarclas, Blacksboat.
J. E. KERR of Harviestoun, Dollar.
JAMES R. LUMSDEN of Arden, Dumbartonshire.
ALEXANDER MURDOCH, East Hallside, Cambuslang, Lanarkshire.
JAMES PATON, Kirkness, Glencraig.
Sir JOSHUA ROSS-TAYLOR, Mungoswalls, Duns.
Major ROBERT W. SHARPE of The Park, Earlston.
T. G. WILSON, Carbeth Home Farm, Balfron Station.
Colonel F. J. CARRUTHERS of Dormont, Lockerbie, Honorary Secretary, *ex officio.*
GEORGE JAMES GREGOR, C.A., Auditor, *ex officio.*

3. PUBLICATIONS.

Colonel F. J. CARRUTHERS of Dormont, Lockerbie, Honorary Secretary, *Convener.*
J. W. ALEXANDER, M.V.O., of Newton, Golfhill, Moffat.
Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh.
JAMES DURNO, Crichie, Inverurie.
WILLIAM I. ELLIOT, Middletoun, Stow, Midlothian.
GEORGE GRANT of Glenfarclas, Blacksboat.
J. E. KERR of Harviestoun, Dollar.
JAMES R. LUMSDEN of Arden, Dumbartonshire.

William Montgomery, North Milton, Kirkcudbright.
Alexander Murdoch, East Hallside, Cambuslang, Lanarkshire.
James Paton, Kirkness, Glencraig.
Captain Ian S. Robertson, Linkwood, Elgin.
Sir Joshua Ross-Taylor, Mungoswalls, Duns.
G. H. Russell of The Burn, Glenesk, Brechin.
The Hon. Walter T. H. Scott, Master of Polwarth, Harden, Hawick.
Major Robert W. Sharpe of The Park, Earlston.
T. G. Wilson, Carbeth Home Farm, Balfron Station.
The Earl of Home, K.T., The Hirsel, Coldstream, Treasurer, *ex officio.*

4. SHOWS.

Ian M. Campbell, Bal Blair, Invershin, *Convener.*
James Paton, Kirkness, Glencraig, *Vice-Convener.*
R. Scott Aiton, M.C., Legerwood, Earlston.
J. W. Alexander, M.V.O., of Newton, Golfhill, Moffat.
David Blair, Littleinch, Wormit, Fife.
Major R. F. Brebner, The Leuchold, Dalmeny House, Edinburgh.
Major A. D. Campbell, Stanstill, Wick.
Alexander Clark, Strathore House, Thornton, Fife.
James Clark, Windlaw House, Carmunnock, Glasgow.
Alexander Cormack (John Wallace & Sons, Ltd.), Sealladh-Mohr, Killearn.
Peter W. Crawford, Dryfeholm, Lockerbie.
James Durno, Crichie, Inverurie.
William I. Elliot, Middletoun, Stow, Midlothian.
Peter Gordon, Balcraig Moor, Port William.
George Grant of Glenfarclas, Blacksboat.
James Hope, Eastbarns, Dunbar.
A. W. Howison of Lochbank, Blairgowrie.
J. E. Kerr of Harviestoun, Dollar.
John Kerr, Yorkston, Gorebridge, Midlothian.
James Kilpatrick, Craigie Mains, Kilmarnock.
James R. Lumsden of Arden, Dumbartonshire.
Finlay MacGillivray of Aldie, Tain.
Thomas M'Lay, Dunvegan, Causewayhead, Stirling.
Ralph S. MacWilliam, Garguston, Muir of Ord, Ross-shire.
A. W. Montgomerie, Westburn Farm, Cambuslang, Lanarkshire.
William Montgomery, North Milton, Kirkcudbright.
Alexander Murdoch, East Hallside, Cambuslang, Lanarkshire.
Robert Park, Brunstane, Portobello, Midlothian.
Captain Ian S. Robertson, Linkwood, Elgin.
Sir Joshua Ross-Taylor, Mungoswalls, Duns.
G. H. Russell of The Burn, Glenesk, Brechin.
The Hon. Walter T. H. Scott, Master of Polwarth, Harden, Hawick.
T. Mercer Sharp, Bardrill, Blackford.
Major Robert W. Sharpe of The Park, Earlston.
John P. Sleigh of St John's Wells, Fyvie.
A. A. Hagart Speirs of Elderslie, Houston House, Renfrewshire.
J. Faed Sproat, Boreland of Anwoth, Gatehouse, Castle Douglas.
Major Sir Samuel Strang Steel of Philiphaugh, Bt., Selkirk.
Matthew Templeton, Goshen Bank, Kelso.
Francis W. Walker of Leys, Leys Castle, Inverness.
T. G. Wilson, Carbeth Home Farm, Balfron Station.
James Wyllie, Beaumont, Victoria Road, Dumfries.
The Earl of Home, K.T., The Hirsel, Coldstream, Treasurer, *ex officio.*
Colonel F. J. Carruthers of Dormont, Lockerbie, Honorary Secretary, *ex officio.*

5. IMPLEMENTS AND MACHINERY.

Sir JOSHUA ROSS-TAYLOR, Mungoswalls, Duns, *Convener*.
JAMES PATON, Kirkness, Glencraig, *Vice-Convener*.
R. SCOTT AITON, M.C., Legerwood, Earlston.
J. W. ALEXANDER, M.V.O., of Newton, Golfhill, Moffat.
ALEXANDER CORMACK (John Wallace & Sons, Ltd.), Sealladh-Mohr, Killearn.
PETER W. CRAWFORD, Dryfeholm, Lockerbie.
JAMES DURNO, Crichie, Inverurie.
PETER GORDON, Balcraig Moor, Port William.
JAMES HOPE, Eastbarns, Dunbar.
J. E. KERR of Harviestoun, Dollar.
JOHN KERR, Yorkston, Gorebridge, Midlothian.
A. W. MONTGOMERIE, Westburn Farm, Cambuslang, Lanarkshire.
WILLIAM MONTGOMERY, North Milton, Kirkcudbright.
ALEXANDER MURDOCH, East Hallside, Cambuslang, Lanarkshire.
Captain IAN S. ROBERTSON, Linkwood, Elgin.
The Hon. WALTER T. H. SCOTT, Master of Polwarth, Harden, Hawick.
T. MERCER SHARP, Bardrill, Blackford.
Major ROBERT W. SHARPE of The Park, Earlston.
JOHN P. SLEIGH of St John's Wells, Fyvie.
J. FAED SPROAT, Boreland of Anwoth, Gatehouse, Castle Douglas.
FRANCIS W. WALKER, of Leys, Leys Castle, Inverness.
T. G. WILSON, Carbeth Home Farm, Balfron Station.
JAMES WYLLIE, Beaumont, Victoria Road, Dumfries.
Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh, Chairman of Board of Directors, *ex officio*.
The EARL OF HOME, K.T., The Hirsel, Coldstream, Treasurer, *ex officio*.
Colonel F. J. CARRUTHERS of Dormont, Lockerbie, Honorary Secretary, *ex officio*.

6. SCIENCE.

Major ROBERT W. SHARPE of The Park, Earlston, *Convener*.
T. G. WILSON, Carbeth Home Farm, Balfron Station, *Vice-Convener*.
R. SCOTT AITON, M.C., Legerwood, Earlston.
J. W. ALEXANDER, M.V.O., of Newton, Golfhill, Moffat.
DAVID BLAIR, Littleinch, Wormit, Fife.
Major R. F. BREBNER, The Leuchold, Dalmeny House, Edinburgh.
IAN M. CAMPBELL, Bal Blair, Invershin.
ALEXANDER CLARK, Strathore House, Thornton, Fife.
JAMES CLARK, Windlaw House, Carmunnock, Glasgow.
PETER W. CRAWFORD, Dryfeholm, Lockerbie.
JAMES DURNO, Crichie, Inverurie.
WILLIAM I. ELLIOT, Middletoun, Stow, Midlothian.
GEORGE GRANT of Glenfarclas, Blacksboat.
JAMES HOPE, Eastbarns, Dunbar.
A. W. HOWISON of Lochbank, Blairgowrie.
J. E. KERR of Harviestoun, Dollar.
JAMES KILPATRICK, Craigie Mains, Kilmarnock.
JAMES R. LUMSDEN of Arden, Dumbartonshire.
FINLAY MACGILLIVRAY of Aldie, Tain.
THOMAS M'LAY, Dunvegan, Causewayhead, Stirling.
A. W. MONTGOMERIE, Westburn Farm, Cambuslang, Lanarkshire.
WILLIAM MONTGOMERY, North Milton, Kirkcudbright.
ALEXANDER MURDOCH, East Hallside, Cambuslang, Lanarkshire.

Robert Park, Brunstane, Portobello, Midlothian.
James Paton, Kirkness, Glencraig.
Sir Joshua Ross-Taylor, Mungoswalls, Duns.
The Hon. Walter T. H. Scott, Master of Polwarth, Harden, Hawick.
T. Mercer Sharp, Bardrill, Blackford.
A. A. Hagart Speirs of Elderslie, Houston House, Renfrewshire.
J. Faed Sproat, Boreland of Anwoth, Gatehouse, Castle Douglas.
Major Sir Samuel Strang Steel of Philiphaugh, Bt., Selkirk.
Francis W. Walker of Leys, Leys Castle, Inverness.
James Wyllie, Beaumont, Victoria Road, Dumfries.
The Earl of Home, K.T., The Hirsel, Coldstream, Treasurer, *ex officio.*
Colonel F. J. Carruthers of Dormont, Lockerbie, Honorary Secretary, *ex officio.*
J. F. Tocher, D.Sc., LL.D., F.I.C., 41½ Union Street, Aberdeen, Chemist, *ex officio.*
A. E. Cameron, M.A., D.Sc., University of Edinburgh, 10 George Square, Edinburgh, Consulting Zoologist, *ex officio.*

7. GENERAL PURPOSES.

Major R. F. Brebner, The Leuchold, Dalmeny House, Edinburgh, Chairman of Board of Directors, *Convener.*
R. Scott Aiton, M.C., Legerwood, Earlston.
David Blair, Littleinch, Wormit, Fife.
Alexander Clark, Strathore House, Thornton, Fife.
James Clark, Windlaw House, Carmunnock, Glasgow.
James Durno, Crichie, Inverurie.
William I. Elliot, Middletoun, Stow, Midlothian.
James Hope, Eastbarns, Dunbar.
J. E. Kerr of Harviestoun, Dollar.
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The Hon. Walter T. H. Scott, Master of Polwarth, Harden, Hawick.
Major Robert W. Sharpe of The Park, Earlston.
The Earl of Home, K.T., The Hirsel, Coldstream, Treasurer, *ex officio.*
Colonel F. J. Carruthers of Dormont, Lockerbie, Honorary Secretary, *ex officio.*

8. EDUCATION.

Colonel F. J. Carruthers of Dormont, Lockerbie, Honorary Secretary, *Convener.*
Major R. F. Brebner, The Leuchold, Dalmeny House, Edinburgh, Chairman of Board of Directors.
Alexander Murdoch, East Hallside, Cambuslang, Lanarkshire.
Sir Joshua Ross-Taylor, Mungoswalls, Duns.
T. G. Wilson, Carbeth Home Farm, Balfron Station.
John Stirton, 8 Eglinton Crescent, Edinburgh, Secretary.

9. OFFICE-BEARERS.

Constitution : (1) The four Ordinary Directors for the Division in which the Show for the year is to be held (with the exception of one retiring next year); (2) one Ordinary Director from each of the other Show Divisions; and (3) the Chairman of the Board, Treasurer, and Hon. Secretary, *ex officiis.*

Perth .	Alexander Clark, Strathore House, Thornton, Fife. James Paton, Kirkness, Glencraig. A. W. Howison of Lochbank, Blairgowrie.
Glasgow .	Alexander Murdoch, East Hallside, Cambuslang, Lanarkshire.
Aberdeen .	George Grant of Glenfarclas, Blacksboat.
Borders .	The Hon. Walter T. H. Scott, Master of Polwarth, Harden, Hawick.
Stirling .	James R. Lumsden of Arden, Dumbartonshire.
Dumfries .	Peter Gordon, Balcraig Moor, Port William.
Edinburgh	James Hope, Eastbarns, Dunbar.
Inverness .	Captain Ian St Robertson, Linkwood, Elgin.

Major R. F. Brebner, The Leuchold, Dalmeny House, Edinburgh, Chairman of Board of Directors, *ex officio.*

The Earl of Home, K.T., The Hirsel, Coldstream, Treasurer, *ex officio.*

Colonel F. J. Carruthers of Dormont, Lockerbie, Honorary Secretary, *ex officio.*

REPRESENTATIVES ON OTHER BODIES.

National Agricultural Examination Board and National Dairy Examination Board.

Colonel F. J. Carruthers of Dormont, Lockerbie.
Major R. F. Brebner, The Leuchold, Dalmeny House, Edinburgh.
Alexander Murdoch, East Hallside, Cambuslang, Lanarkshire.
Sir Joshua Ross-Taylor, Mungoswalls, Duns.
T. G. Wilson, Carbeth Home Farm, Balfron Station.
John Stirton, 8 Eglinton Crescent, Edinburgh.

Edinburgh and East of Scotland College of Agriculture.

John Stirton, *Secretary*, Highland and Agricultural Society of Scotland, 8 Eglinton Crescent, Edinburgh.

West of Scotland Agricultural College.

James R. Lumsden of Arden, Dumbartonshire.

Aberdeen and North of Scotland College of Agriculture.

J. F. Tocher, D.Sc., LL.D., F.I.C., 41½ Union Street, Aberdeen.

Royal (Dick) Veterinary College.

Major R. F. Brebner, The Leuchold, Dalmeny House, Edinburgh.

Glasgow Veterinary College.

Alexander Murdoch, East Hallside, Cambuslang, Lanarkshire.

Scottish Milk Records Association.

James Kilpatrick, Craigie Mains, Kilmarnock.
William Montgomery, North Milton, Kirkcudbright.
Captain Ian S. Robertson, Linkwood, Elgin.

National Trust for Scotland.

The Hon. Walter T. H. Scott, Master of Polwarth, Harden, Hawick.

Royal Scottish Agricultural Benevolent Institution.

Major R. F. Brebner, The Leuchold, Dalmeny House, Edinburgh.

Association for the Preservation of Rural Scotland.

The Hon. Walter T. H. Scott, Master of Polwarth, Harden, Hawick.

Scottish Country Industries Development Trust.

The Hon. Walter T. H. Scott, Master of Polwarth, Harden, Hawick.
Laurence R. Younger, Dabton, Thornhill, Dumfriesshire.

Scottish National Association of Young Farmers' Clubs.

James Paton, Kirkness, Glencraig.

SCOTTISH PLANT REGISTRATION STATION.

Standing Committee of Management.

Major R. F. Brebner, The Leuchold, Dalmeny House, Edinburgh.
James Hope, Eastbarns, Dunbar.
James Wither, Awhirk, Stranraer.

Appointed for 5 years from 1st January 1941.

MEETINGS.

General Meetings.—By the Charter the Society must hold two General Meetings each year, and, under ordinary circumstances, they are held in the months of January and June, for the election of Members and other business. Twenty a quorum.

By a resolution of the General Meeting held on 15th January 1879, a General Meeting of Members is held in the Showyard on the occasion of the Annual Show.

With reference to motions at General Meetings, Bye-Law No. 19 provides that—" At General Meetings of the Society no motion or proposal (except of mere form or courtesy) shall be submitted or entertained for immediate decision unless notice thereof has been given two weeks previously to the Board of Directors, without prejudice, however, to the competency of a motion or proposal, of which due notice has not been given, being remitted to the Directors for consideration, and thereafter being disposed of at a future General Meeting."

Directors' Meetings.—The Board of Directors meet (except when otherwise arranged) on the first Wednesday of each month from November to June, inclusive, at 1.30 P.M., and occasionally as business may require, on a requisition by three Directors to the Secretary, or on intimation by him. Seven a quorum.

Committee Meetings.—Meetings of the various Committees are held as required.

Nomination of Directors.—Meetings of Members, for the purpose of nominating Directors to represent the Show Divisions on the Board for the year 1943-1944, will be held at the places and on the days after-mentioned :—

DIVISION.		
1. *Edinburgh.*	Market Buildings, Gorgie, Edinburgh .	Wed., 27th Jan. 1943, at 1.
2. *Glasgow.*	Central Station Hotel, Glasgow	Wed., 10th Feb. 1943, at 1.
3. *Stirling.*	Golden Lion Hotel, Stirling	Thur., 11th Feb. 1943, at 1.30.
4. *Perth.*	Station Hotel, Cupar	Tues., 16th Feb. 1943, at 2.30.
	(The Meeting will be held in 1944 and 1945 at Perth.)	
5. *Borders.*	........, St Boswells .	Thur., 18th Feb. 1943, at 3.
6. *Inverness.*	Station Hotel, Inverness	Tues., 23rd Feb. 1943, at 2.
7. *Aberdeen.*	Imperial Hotel, Aberdeen	Fri., 26th Feb. 1943, at 2.30.
8. *Dumfries.*	King's Arms Hotel, Dumfries	Wed., 10th March 1943, at 2.

The nomination of a Proprietor or other Member paying the higher subscription must be made in the 1st, 2nd, 4th and 5th Divisions ; and the nomination of a Tenant-Farmer or other Member paying the lower subscription in the 3rd, 6th, 7th and 8th Divisions.

A Member who has served as an Ordinary Director for a term of four years is not eligible to be nominated again till after the laspse of at least one year. An Extraordinary Director may, however, be nominated as an Ordinary Director.

GENERAL SHOW.

Owing to the outbreak of War, the Board of Directors decided to cancel all Shows for the duration of the War.

EXAMINATIONS.

Agriculture.—The Examination in 1942 for the National Diploma in Agriculture will be held at the University of Leeds on Wednesday, 8th April, and following days. Applications close on Friday, 20th February.

Dairying.—The Examination in 1942 (Scottish Centre) for the National Diploma in Dairying will be held at the Dairy School for Scotland, Auchincruive, Ayr: *Written*—On Wednesday, Thursday, and Friday, 2nd, 3rd, and 4th September. *Oral and Practical*—On Monday, 14th September, and following days. Applications close on Friday, 31st July.

Forestry.—The Final Examination for the Society's First and Second-Class Certificates in Forestry was held in 1935.

In view of the institution of Examinations for Certificates and Diplomas in Forestry by the Royal Scottish Forestry Society, and by arrangement with that Society, the Board of Directors of the Highland and Agricultural Society of Scotland resolved in 1935 to cease holding further Examinations for the First and Second-Class Certificates, and that, in future, the granting of Certificates and Diplomas be left in the hands of the Royal Scottish Forestry Society.

All communications in connection with Examinations in Forestry should now be addressed to the Secretary, Royal Scottish Forestry Society, 8 Rutland Square, Edinburgh 1.

NATIONAL DIPLOMA IN AGRICULTURE

By a Supplementary Charter under the Great Seal, granted in 1856, the Society is empowered to grant Diplomas.

From 1858 to 1899 the Society held an annual Examination for Certificate and Diploma in Agriculture. In 1873 the Free Life Membership of the Society was granted to winners of the Diploma. In 1882 permission was given to holders of the Diploma to append the letters F.H.A.S. to their names. These arrangements terminated in 1899.

In 1898 it was resolved by the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland to discontinue the independent Examinations in Agriculture held by the two Societies, and to institute in their stead a Joint-Examination for a NATIONAL DIPLOMA IN AGRICULTURE (N.D.A.). This Examination is now conducted under the management of "The National Agricultural Examination Board" appointed by the two Societies. The first Joint Examination was held in 1900.

REGULATIONS FOR EXAMINATION IN THE SCIENCE AND PRACTICE OF AGRICULTURE

EXAMINATION IN 1942.

1. The Societies may hold conjointly, under the management of the National Agricultural Examination Board appointed by them, an Annual Examination in the Science and Practice of Agriculture, at a convenient centre.

2. Candidates who pass the Examination will receive the National Diploma in Agriculture—the Diploma to be distinguished shortly by the letters "N.D.A."

3. The Examination will be conducted by means of written papers and oral examinations.

4. In order to be eligible to sit for the Board's Examination in Agriculture, a candidate must—

(*a*) Present a certificate from a recognised Agricultural College that his attainments in the subjects of *General Botany, Geology, General Chemistry, Physics, and Mechanics*, as attested by class and other examinations, are, in the opinion of the authorities of the College, such as to justify his admission to the Board's Examination; *or*

(*b*) Produce evidence that he has passed the 1st B.Sc. or the Intermediate Examination in Science of a British University; *or*

(*c*) Present a School Certificate awarded by a British University Examination Board, and produce evidence that he has continued his study of science for at least a year and has obtained a certificate in Physics, Chemistry and Botany at the Higher Certificate Examination of a British University Examination Board; *or*

(*d*) Present a Leaving Certificate in Science (including Chemistry and Botany) of the Scottish Education Department.

5. In the case of students who satisfy the Board that they have not had the facilities for obtaining the foregoing certificates, the Board will be prepared to consider evidence of equivalent attainment. [Applications under this rule must be lodged *three months* before the date of the annual examination.]

6. *Before sitting for the* PRACTICAL AGRICULTURE *and* FARM MACHINERY AND IMPLEMENTS *papers, all candidates must produce evidence of possessing a practical knowledge of Agriculture obtained by residence on a farm in the British Isles for a period or periods* (*not more than two*) *covering a complete year of farming operations.*

7. Candidates will have the option of taking the whole of the following nine papers at one time, or of sitting for a group of *any three, four, or five* in the first year and the remaining subjects (at one examination) within the next two years:—

SUBJECT.	Maximum Marks.	Pass Marks.
1. Practical Agriculture (First Paper)	400	240
2. Practical Agriculture (Second Paper)	400	240
3. Farm Machinery and Implements	300	150
4. Land Surveying and Farm Buildings	100	50
5. Agricultural Chemistry	200	100
6. Agricultural Botany	200	100
7. Agricultural Book-keeping	200	100
8. Agricultural Zoology	100	50
9. Veterinary Science and Hygiene	200	100
	2100	1130

NOTE.—Candidates taking the Examination in two groups of subjects are recommended to take Agricultural Chemistry and Agricultural Botany in the first group.

8. A candidate who obtains not less than three-fourths (1575) of the aggregate maximum marks (2100) in the entire Examination will receive the Diploma with Honours, provided that he obtains not less than three-fourths (600) of the maximum marks (800) in the two Practical Agriculture papers.

9. Candidates electing to take the entire Examination at one time and failing in not more than three subjects may appear for these subjects in the following year. Failure in more than three subjects will be regarded as failure in the whole Examination.

10. In the case of candidates electing to take the Examination in two groups—

(*a*) A candidate appearing for a group of *three* subjects and failing in a single subject may, *in the case of a first group*, appear for that subject along with the second group, or, *in the case of a second group*, in the following year. Failure in more than one subject will be regarded as failure in the group.

(*b*) A candidate appearing for a group of *four* or more subjects and failing in not more than two subjects may, *in the case of a first group*, appear for these subjects along with the second group, or, *in the case of a second group*, in the following year. Failure in more than two subjects will be regarded as failure in the group.

11. Non-returnable fees must be paid by candidates as follows:—

Entire Examination . . .	Six guineas.
Group of subjects	Three guineas.
Reappearance for any subjects .	10/6 per subject.

12. The Board reserve the right to postpone, abandon, or in any way, or at any time, modify an Examination, and also to decline at any stage to admit any particular candidate to the Examination.

The Examination will take place at LEEDS UNIVERSITY on WEDNESDAY, 8TH APRIL 1942, and following days.

Forms of Application for permission to sit at the Examination may be obtained from "The Secretary, Royal Agricultural Society of England, 16 Bedford Square, London, W.C.1." or from "The Secretary, Highland and Agricultural Society of Scotland, 8 Eglinton Crescent, Edinburgh 12," and must be returned duly filled up not later than FRIDAY, 20TH FEBRUARY 1942.

SYLLABUS OF SUBJECTS OF EXAMINATION.

PRACTICAL AGRICULTURE.

I.—FIRST PAPER.

1. *British Farming.*—Arable, stock-raising, dairying—Approximate areas covered by the different systems—Typical examples of each—Area in Great Britain under chief crops—Numbers of live stock—The recent history of agriculture—Short summary of agricultural returns.

2. *Climate.*—The effect of climate on farming practice—Rainfall—Temperature—Prevailing winds—Weather forecasts.

3. *Soils.*—The influence of geological formations on the systems of farming—Classification of soils—Character and composition—Suitability for cultivation. Reclamation—Drainage—Irrigation—Warping—Application of lime and marl—Bare fallows—Tillage—Subsoiling—Deep and thorough cultivation.

4. *Manures.*—The manures of the farm—The treatment of farmyard manure—The disposal of liquid manure and sewage—General manures—Special manures—Field trials of manures—The application of manures—Period of application and amounts used per acre—Unexhausted value of manures and feeding-stuffs.

5. *Crops.*—Wheat, barley, oats, rye, beans, peas, potatoes, turnips, swedes, mangolds, sugar beet, forage plants, hops, and other crops—Their adaptation to different soils and climates—Varieties—Selection of seed—Judging seeds—Cultivation, weeds and parasitic plants, best methods of prevention and eradication—Harvesting—Storing—Cost of production—Improvement of crops by selection and hybridising—Field trials—Methods which the farmer may adopt—Selection to resist disease—The principles of rotations—Rotations suitable for different soils and climates—Rotations and the maintenance of fertility—Green manuring—Leguminous crops in rotation—Catch crops—The advantages and disadvantages of rotations—Specialised farming—Management of Orchards.

2.—Second Paper.

6. *Live Stock.*—The different breeds of British live stock—Their origin, characteristics, and comparative merits—Suitability for different districts—Breeding—General principles—Selection—Mating—Crossing—Rearing and general management—Breeding and rearing of horses, cattle, sheep, pigs, and poultry. Rearing colts and raising store stock—The foods of the farm—Their composition and suitability for different classes of stock—Purchased foods—Composition and special value—Rations for different kinds and ages of stock—Cost of producing beef, mutton, pork, and milk—Cost of feeding farm horses.

7. *The disposal of Crops, Produce, and Stock.*—Marketing grain and other crops—Sale of stock—Live weight—Dead weight.

8. *Milk.*—The production and treatment of milk—The manufacture of cheese, butter, &c.—The utilisation of by-products.

9. *Farming Capital.*—Calculations of the stocking and working of arable, stock, and dairy farms—Farm valuations—Rent and taxes.

10. *Labour.*—Organisation of labour—piece-work, time-work—labour costings.

11. *Renting a Farm.*—Indications of condition, productive power, and stock-carrying capacity—Leases—Conditions of occupancy.

N.B.—*It is essential that a candidate know his subject practically, and that he satisfy the Examiner of his familiarity with farm work and management.*

3.—FARM MACHINERY AND IMPLEMENTS.

1. *Power.*—The principle of action, construction, method of working, also care and management of steam engines and boilers, gas, oil and petrol engines and agricultural tractors. Cost and working expenses in connection with the above. Estimation of the brake horse-power of engines. Power derived from water. Measurement of the quantity of water flowing in a stream. General arrangement of water-power plants. Water-wheels. Turbines. Pumps—principle of action and construction. Flow of water through pipes. Hydraulic ram. Windmills.

2. *Agricultural Implements and Machinery.*—The mode of action and the general principles involved in the construction and working of farm implements and machinery. Arrangements of machinery with respect to the power plant. Pulleys and belting. Shafting and bearings. Lubrication. Lifting appliances. Strength and care of chains. Concrete and its use in the construction of simple foundations for engines and machines.

3. *Implements of Cultivation.*—Ploughs—Cultivators—Grubbers—Harrows—Drills. Manure Distributors. Seeding and planting implements.

4. *Implements of Harvesting.*—Mowing and Reaping machines—Rakes—Tedders—Elevators—Potato raisers.

5. *Implements of Transit.*—Carts, waggons, rick lifters, tractors.

6. *Threshing and Food-preparing Machinery.*—Threshing machines, stationary and portable—Screen Winnowers—Hummelers, Chaff cutters—Pulpers—Cake breakers.

7. *Dairy Appliances.*—Milking machines—Cream separators—Churns and other butter-working appliances—Milk delivery cans—Cheese-making utensils—Vats and presses.

N.B.—*Candidates are expected to have had some experience with agricultural machinery and implements under actual working conditions, and to be capable of illustrating their answers, when necessary, by intelligible sketches or diagrams.*

4.—LAND SURVEYING AND FARM BUILDINGS.

1. The use and adjustment of instruments employed in Surveying and Levelling other than the Theodolite.

2. Land surveying by chain, Plotting from field book, and determination of areas surveyed. The simpler "field problems."

3. Levelling and plotting from field book.

4. A knowledge of the various classes of maps published by the Ordnance Survey Department and their Scales.

5. *Roads and Fences.*—The construction and maintenance of farm roads, fences, and ditches.

6. *Land Drainage.*—Methods of draining; mole and pipe drains; cost of construction and maintenance.

7. *Buildings.*—Buildings required on different classes of farms—Economical arrangement of farm buildings—Materials—Construction—Ventilation—Drainage—Water supply—Dimensions of dairy, stables, cowsheds, yard, courts, and piggeries—Accommodation for power—Implement, machinery, and cart sheds—Hay and grain sheds—Shelter sheds—Storage of manure.

N.B.—*Each candidate should have with him at the Examination a pair of compasses, scales of equal parts, including scales of one chain to the inch,* 4 *feet to the inch,* 8 *feet to the inch, and the scale fitting the Ordnance Map,* $\frac{1}{2500}$ *or* 25·344 *inches to the mile, a small protractor, a set-square, and a straight-edge about* 18 *inches in length.*

5.—AGRICULTURAL CHEMISTRY.

1. *The Atmosphere.*—Its composition and relations to plant and animal life.

2. *Water.*—Rain water—Soil water and drainage—Drinking water—Sewage and irrigation.

3. *The Soil.*—Origin, formation, and classification of soils—Sampling—Analysis—Composition of soils—The chemical and physical properties of soils—The water and air of the soil—Biological changes in the soil—The soil in relation to plant growth—Fertility—Causes of infertility—Improvement of soils.

4. *Manures.*—Theories of manuring—Classification of manures—Origin, nature, and characteristics of manures—Manufacture of

manures—Composition, analysis, adulteration, and valuation of manures—Farmyard manure and other natural manures—Green-manuring—Liming, marling, claying—Artificial manures, their origin and manufacture—Fertilisers and Feeding Stuffs Act—Sampling of manures.

5. *Poisons, Antiseptics, and Preservatives.*—General chemical composition and character of insecticides, fungicides, antiseptics, and preservatives used on the farm.

6. *Plants and Crops.*—Constituents of plants—Assimilation and nutrition of plants—Sources of the nitrogen and other constituents of plants—Germination—Action of enzymes—Composition and manurial requirements of farm crops—Food products derived from crops—Manuring experiments.

7. *Animals.*—Composition of animal body—Animal nutrition—Digestion—Assimilation, metabolism, respiration, and excretion.

8. *Foods and Feeding.*—Constituents of foods—Origin, nature, and composition of chief feeding stuffs—Sampling, analysis, and adulteration of foods—Nutritive value and digestibility of food—Functions of chief food constituents—Energy values—Vitamins—Relation of foods to the production of work, meat, milk, and manure—Manurial residues of foods.

9. *Dairy Chemistry.*—The composition of milk, cream, butter, cheese, &c.—Conditions which influence the composition of milk and milk products—Action of ferments and enzymes on milk and milk products—Milk-testing—Analysis and adulteration of dairy products.

N.B.—*Candidates who are in possession of Laboratory Notes are required to bring them to the Oral Examination in this subject.*

6.—AGRICULTURAL BOTANY.

In addition to a *general knowledge* of the morphology, histology, and physiology of plants, candidates will be expected to possess a *detailed knowledge* of the following subjects:—

The classification of plants of importance in agriculture as shown by a detailed study of the genera, species, and botanical varieties of the British Crop Plants and Weeds included in the following families:—

Ranunculaceæ.
Cruciferæ.
Caryophyllaceæ.
Leguminosæ.
Rosaceæ.
Umbelliferæ.
Compositæ.
Solanaceæ.
Scropulariaceæ.
Labiatæ.
Chenopodiaceæ.
Polygonaceæ.
Liliaceæ.
Gramineæ.

British grasses of agricultural importance: recognition of, at any stage of growth. Habitats of important species. Constitution of the grass flora of good meadows and pastures. Composition of seed mixtures for temporary and permanent leys on various soils. The effects of artificial manures on the flora of grass land.

The weeds of arable and grass land. Poisonous and parasitic weeds. Methods of distribution by seed and vegetatively: of eradication. Weeds as soil indicators. Recognition of the seeds of the common weeds, particularly those characteristically found in clover, grass, &c., seed.

The chief varieties of wheat, barley, oats, clovers, roots, and other farm crops; their suitability for various climatic and soil conditions. The identification of the more important types of cereals by means of their grain characters. Characteristics of good and bad samples of cereals.

Identification of materials used in feeding cakes and meals.

Plant-breeding. Principles of heredity in plants. Pure lines. Fluctuating variability. Selection.

Disease in plants. Diseases due to the effects of parasitic fungi. Resistance to disease: conditions affecting. Fungoid diseases scheduled from time to time by the Ministry of Agriculture and Fisheries.

Yeasts and fermentation.

The general outlines of bacteriology: nitrogen fixation, nitrification, and denitrification. Putrefaction and the bacteriology of milk, butter, and cheese.

N.B.—*Candidates who are in possession of Laboratory Notes are required to bring them to the Oral Examination in this subject.*

7.—AGRICULTURAL BOOK-KEEPING.

1. Advantages of book-keeping to the farmer. Difficulties and how they can be overcome. Objects of book-keeping.
2. General principles of book-keeping. Double-entry system. Description and use of various books. Ledger, journal, cash-book, petty cash-book, day-books, &c. Entering transactions; posting; trial balance; closing the accounts. Single-entry system.
3. Special ledger accounts: Interest depreciation, rent and rates, improvements, private and household expenses, profit and loss and capital; partnership accounts.
4. Bank business. Opening a bank account. Use of cheques. Deposits and overdrafts.
5. General office work; correspondence, order notes, invoices, rendering accounts, receipts, &c. Filing systems.
6. Farm valuations for book-keeping purposes. Dates for stock-taking and principles of valuation. The farm balance-sheet.
7. Systems of farm book-keeping. Conditions that determine the most suitable system. Advantages and drawbacks of each system.
8. Accounts for the owner-occupier. Treatment of rent. Incidence of rates and tithe in England and Scotland, and their treatment as between farm and estate accounts. Improvements and upkeep and the general principles relating to maintenance claims.
9. Cost accounting. General principles and methods. Advantages, objects, difficulties.
10. Interpretation of results from ordinary and from cost accounts. Precautions necessary. Use of accounts as a guide to efficient management.
11. Income Tax. How the farmer is assessed. Preparation of Income Tax return. Treatment of Income Tax in accounts.

8.—AGRICULTURAL ZOOLOGY.

The Examination is designed to test practical knowledge, and therefore Candidates will be expected to recognise the animals of agricultural importance referred to in the Syllabus.

GENERAL.

A general knowledge of the characteristics of living animals and how they differ from plants.

One-celled animals, *e.g.*, Amœba, and many-celled animals.

General outline of the classification of animals and the characters on which it is based.

Organic Evolution. Theories of Heredity.

SPECIAL.

I. *Invertebrates.*—A. The Worm Parasites of Stock. Flat and Round Worms. Structure and Life History, for example, of Liver-fluke, Tapeworm, Ascaris. The mode of life and life history of the chief worm enemies of the domesticated animals. Preventive and remedial measures.

B. The Arachnid enemies of Stock: Mange or Scab Mites, Demodex Mites, Ticks. External structure and life history. Control measures.

C. The Insect enemies of Stock: (*a*) External parasites, *e.g.*, gadflies, warble flies, blue-bottles, green-bottles, stable fly, ked, lice; (*b*) Internal parasites, *e.g.*, bot and warble flies.

D. Insects injurious to Crops: Structure and classification of insects. Mode of life and life history of the chief insect pests of agricultural crops.* Control, preventive and remedial measures—natural control; artificial control (Insecticides).

* *The chief pests are detailed in Pamphlets issued by the Ministry of Agriculture and Fisheries.*

E. Other invertebrates of agricultural importance, *e.g.*, earthworms, eelworms, slugs and snails, centipedes and millepedes, gall mites.

II. *Vertebrates.*—Birds: the commoner birds of farm importance, their recognition and an estimate of their work.

Mammals: Outstanding characters for recognition, and the economic importance of:—

1. Ungulata or Hoofed Mammals, *e.g.*, horse, pig, cattle, sheep, deer.
2. Rodentia or Gnawing Mammals, *e.g.*, hares, rabbits, rats, mice, voles, squirrels.
3. Insectivora, *e.g.*, mole, hedgehog, shrew.
4. Carnivora, *e.g.*, dog, fox, polecat, stoat, weasel, badger.

N.B.—*Candidates who are in possession of Laboratory Notes are required to bring them to the Oral Examination in this subject.*

9.—VETERINARY SCIENCE AND HYGIENE.

1. Elementary anatomy and physiology of the horse, ox, sheep, and pig, and their relation to unsoundness and disease.

2. The general principles of breeding—including the physiology of reproduction, the laws of heredity, the periods of gestation, and the signs of pregnancy in the mare, cow, ewe, and sow.

3. Dentition as a means of determining the age of horses, cattle, sheep, and swine.

4. The management of farm stock in health and disease.

N.B.—*Candidates who are in possession of Laboratory Notes are required to bring them to the Oral Examination in this subject.*

WINNERS OF DIPLOMA IN 1941.

Diploma.

Ottiwell Cuthbert Atkinson, University of Leeds.

Richard Allen Bates, Midland Agricultural College, Sutton Bonington, Loughborough.

William Duncan Bolt, Seale Hayne Agricultural College, Newton Abbot, Devon.

Derrick Strickland Brook, South-Eastern Agricultural College, Wye, Kent.

Harold James Murray Brown, Harper Adams Agricultural College, Newport, Shropshire.

William Donaldson Carr, King's College, Newcastle-upon-Tyne.

Duncan John Fleming Colville, West of Scotland Agricultural College, Glasgow.

Basil John Skidmore Cooke, Midland Agricultural College, Sutton Bonington, Loughborough.

Henry Shepherd Davidson, King's College, Newcastle-upon-Tyne.

William George Day, Midland Agricultural College, Sutton Bonington, Loughborough.

Richard John Fox, Midland Agricultural College, Sutton Bonington, Loughborough.

Michael William Green, Essex Institute of Agriculture, Chelmsford.

Robert M'Intyre Greenshields, West of Scotland Agricultural College, Glasgow.

Robin Grinsted, University of Reading.

Ian Donald Kermode Halkerston, University of Reading.

Melfyn Thomas Jones, University of Reading.

Samuel John Kingston, Harper Adams Agricultural College, Newport, Shropshire.

Thomas William MacGuffie, East of Scotland College of Agriculture, Edinburgh.

Duncan Campbell M'Intyre, West of Scotland Agricultural College, Glasgow.

George William Mann, University of Leeds.

Robert Frederick Muscutt, Midland Agricultural College, Sutton Bonington, Loughborough.

John Edmund Clarke Oxenham, Seale Hayne Agricultural College, Newton Abbot, Devon.

Robert Muir Patterson, West of Scotland Agricultural College, Glasgow.

Graham Henderson Paul, West of Scotland Agricultural College, Glasgow.

Evan Islwyn Prytherch, University College of Wales, Aberystwyth.

HARRY FRANK HAINES ROBERTS, Midland Agricultural College, Sutton Bonington, Loughborough.

JOSEPH WILLIAM ROWLAND, Midland Agricultural College, Sutton Bonington, Loughborough.

CHARLES MACFARLANE STEWART SCRIMGEOUR, University of Glasgow and West of Scotland Agricultural College.

WILLIAM FRASER STEPHEN, University of Glasgow and West of Scotland Agricultural College.

WILLIAM ARTHUR WALSH, University of Leeds.

PETER HAYDEN WILKINSON, Midland Agricultural College, Sutton Bonington, Loughborough.

EXAMINATION PAPERS OF PAST YEARS.

Copies of papers set at past Examinations in AGRICULTURE, so far as available, may be had on application. Price 6d. per set.

Sets of N.D.A. Papers available are those for the years 1937, 1938, 1939, 1940 (April), 1940 (July), 1941.

NATIONAL DIPLOMA IN DAIRYING

This Examination, instituted in 1897, is conducted by "The National Dairy Examination Board," appointed jointly by the Royal Agricultural Society of England, the Highland and Agricultural Society of Scotland, and the British Dairy Farmers' Association.

REGULATIONS FOR EXAMINATION IN THE SCIENCE AND PRACTICE OF DAIRYING

EXAMINATION IN 1942.

1. The Societies may hold annually in England and Scotland, under the management of the National Dairy Examination Board appointed by them, one or more examinations for the National Diploma in the Science and Practice of Dairying, on dates and at places from time to time appointed and duly announced ; the Diploma to be distinguished shortly by the letters 'N.D.D.'

2. Forms of entry for the Examination in England may be obtained from "The Secretary, Royal Agricultural Society of England, 16 Bedford Square, London, W.C.1." and must be returned to him duly filled up, with the entry fee, on or before 20th July 1942.

3. Forms of entry for the Examination in Scotland may be obtained from "The Secretary, Highland and Agricultural Society of Scotland, 8 Eglinton Crescent, Edinburgh 12," and must be returned to him duly filled up, with the entry fee, on or before 31st July 1942.

4. Any candidate may enter for the Examination either in England or Scotland, but not in both, and a candidate who has once taken part in an Examination in England cannot enter for an Examination in Scotland, or *vice versa. An exception may be made in favour of a candidate reappearing under Regulation* 10 (3) *provided special application is made at the time of entry.*

5. As a preliminary to the acceptance of any application for permission to enter for the Examination, a candidate must produce :—

(1) from the Head of an approved Dairy Training College or Institute :

(*a*) a statement that he or she is in possession of the General School Certificate (England), the Day School Certificate Higher (Scotland), or the School Certificate of the Central Welsh Board ; *or* a statement that his or her general education is of an equivalent standard ;

(*b*) a certificate testifying that he or she has satisfactorily completed courses in (i) soils, crops, rotations, cultivations, manuring of crops (other than pastures), and plant physiology; (ii) elementary chemistry, physics and mechanics, *and*

(*c*) that he or she has also attended a Diploma or Degree course in the subjects of the Examination covering at least two academic years at an approved Dairy Training College or Institute, and has satisfied the authorities of the College or Institute of his or her fitness for admission to the Examination. *This period shall include six months' instruction (consisting of not more than two periods) in practical dairy work.*

(*d*) a certificate of proficiency in soft cheese-making.

(2) a certificate of proficiency in the milking of cows, signed by a dairy farmer, and evidence that he or she has spent at least six months in not more than two periods on an approved dairy farm and taken part in the work, both in the dairy and on the land. *This period must not run concurrently with the six months' practical training referred to in sub-section* 1 (*c*).

A Dairy Farm to be approved must have not fewer than fifteen cows in milk.

6. A candidate who has already taken a Degree in Agriculture of a British University, or a Diploma in Agriculture recognised by the National Dairy Examination Board, will be allowed to enter for the National Diploma in Dairying Examination after one year's subsequent training at an approved Dairy Training College or Institute, providing that such course includes at least six months' training in practical dairy work, and that he or she has spent at least six months on an approved dairy farm, and taken part in the work both in the dairy and on the land.

7. In the Examination a candidate will be required to satisfy the Examiners by means of written papers, practical work, and *viva voce*, that he or she has:—

(1) A general knowledge of the management of a dairy farm, including the rearing and feeding of dairy stock, the candidate being required to satisfy the Examiners that he or she has had a thorough training and practical experience in all the details of dairy work as pursued on a farm.

(2) A thorough acquaintance with the practical details of the management of a dairy, and the manufacture of butter and cheese, together with a working knowledge of the scientific principles involved in these operations.

(3) A general knowledge of dairy book-keeping.

(4) Practical skill in dairying, to be tested by the making of butter and cheese.

NOTE.—A candidate must be prepared to make any one of three varieties of Hard Pressed Cheese, two of which must be Cheddar and Cheshire, these three to be specified on his application form, the Examiner in Cheese-making having the option of saying, during the Examination, which a candidate shall make.

8. Candidates will have the option of :—

(*a*) Taking the whole Examination at one time ; or
(*b*) Taking the Examination in two parts.

A candidate taking the Examination in two parts must take the following subjects at the first sitting: DAIRY HUSBANDRY, MILK AND MILK PLANT, CREAM AND BUTTER, CHEESE AND CHEESE PRODUCTS, PRACTICAL CHEESE-MAKING AND BUTTER-MAKING ; the remaining three Papers, DAIRY CHEMISTRY, DAIRY MICROBIOLOGY, and DAIRY BOOK-KEEPING, at the Examination in the following year.

9. The maximum marks obtainable and the marks required for a pass in each subject are :—

WRITTEN AND ORAL EXAMINATION—		Max.	Pass.
Dairy Husbandry	(3 *hours' paper*)	150	90
Milk and Milk Plant	(2 *hours' paper*)	100	60
Cream and Butter	,, ,,	100	60
Cheese and Cheese Products	,, ,,	100	60
Dairy Chemistry	,, ,,	100	60
Dairy Microbiology	,, ,,	100	60
Dairy Book-keeping	,, ,,	100	50
PRACTICAL EXAMINATION—CHEESE-MAKING—			
(*a*) One of the three Hard Pressed cheeses specified by the candidate on his form of application		200	150
(*b*) Blue-veined		100	75
BUTTER-MAKING		200	150
		1250	815

Honours will be awarded to candidates obtaining an aggregate of 80 per cent (1000) of the maximum marks (1250) in the Examination, provided that they also obtain at least 80 per cent (360) of the maximum marks (450) in the Dairy Husbandry, Milk and Milk Plant, Cream and Butter, and Cheese and Cheese Products papers.

10. A candidate taking the whole Examination at one time :—

(1) who fails in any part of the practical examination shall fail in the whole examination.
(2) who fails in four or more subjects of the written examination shall fail in the whole examination.
(3) who, having passed in the practical examination, fails in not more than three subjects of the written examination may, at the discretion of the Board, appear for those subjects in the following year.

11. A candidate taking the Examination in two parts, and failing in a single subject in the first part of the Examination, may, at the discretion of the Board, appear for that subject along with the second part ; or, in the case of a single subject of the second part, in the following year.

Failure in more than one subject will be regarded as failure in that part of the Examination. Failure in any part of the Practical Examination will entail complete failure.

12. In all cases of failure, either in the whole Examination or in part thereof, the Board will require evidence of further study before a candidate is again admitted to the Examination.

13. The entrance fees will be as follows:—

For the whole Examination taken at one time .	£3	3	0
For the Examination taken in two parts:			
First part	3	3	0
Second part	1	1	0

For reappearance, 10s. 6d. each subject.

14. The Board reserve the right to postpone, to abandon, and to modify an Examination, and also to decline to admit any particular candidate to the Examination.

DATES OF EXAMINATIONS.

SCOTLAND.—At the Dairy School for Scotland, Auchincruive, Ayr. WRITTEN—Wednesday, Thursday, and Friday, 2nd, 3rd and 4th September 1942. ORAL AND PRACTICAL—Monday, 14th September 1942 and following days. Last date for receiving Applications, Friday, 31st July 1942.

ENGLAND.—At the University and British Dairy Institute, Reading. Wednesday, 2nd September 1942 and following days. Last date for receiving Applications, Monday, 20th July 1942.

SYLLABUS OF SUBJECTS OF EXAMINATION

I.—DAIRY HUSBANDRY.

Buildings of the dairy farm; structural features, sanitation, and water supply.

Selection, stocking, and equipment of typical dairy farms; organisation of the dairy farm.

The utilisation of the crops of the dairy farm.

Pastures and pasture management; dried grass, silage.

Foods used on the dairy farm; characteristics and relative value.

Live stock of the dairy farm; essential conformation features of the dairy cow and dairy bull; British dairy breeds; milk recording.

Breeding of dairy stock, principles and practice; selection, care, and management of the sire; calf rearing; raising of dairy heifers.

Management of dairy herds; self-contained herds; attested herds.

Feeding of dairy cows for milk production; feeding standards, construction and use of rations.

Common ailments and diseases of dairy stock; milk fever, bloat cow pox, mastitis, contagious abortion, tuberculosis, Johne's disease sterility, scour, hoose, notifiable animal diseases.

Hygienic milk production; hand and machine milking; cleaning and care of milking machines and utensils used in milk production; milk coolers and farm sterilising equipment.

Pigs on the dairy farm; suitable breeds for bacon and for pork production; housing accommodation; breeding, feeding, and management of pigs; fattening of pigs; pig recording; common ailments and diseases of pigs.

II.—MILK AND MILK PLANT.

Utilisation of milk and milk products in Great Britain; sources of supply; the principles of organised marketing. Milk contracts.

Properties of milk.

Variations in the composition of milk; legal minimum standards for milk; statutory rules and orders relating to milk and milk products.

Sources of taints and contamination in milk. Abnormal milk. Flavour in milk and the contributing factors.

Grades of milk.

Food value of milk. Hard and soft curd milk.

Transportation of milk; milk churns; road and rail tanks; processing of milk at milk depots; sampling and testing of milk; effects of heat on milk; essentials for efficient pasteurisation; progressive stages in milk treatment at milk plants; weighing; filtering; clarifying, pumping, pasteurising, cooling, bottling, and capping; refrigeration; cold storage.

Disposal of wastes from milk plants.

Distribution of milk.

Special treatment of milk; homogenisation, irradiation, stassanisation, commercial sterilisation, high temperature, short time heat treatment.

Fermented milk preparations, Yoghurt, Kefir, and cultured butter milk.

Elementary principles of condensing and drying of milk.

III.—CREAM AND BUTTER.

Cream.—Production and consumption of cream in Great Britain. Utilisation of cream; grades of cream, regulations for the sale of cream; different methods of obtaining cream from milk.

Operation and management of cream separators, hand and power.

Efficiency of separation; cleaning and sterilisation of separators.

Testing of cream.

Factors influencing the flavour, physical properties, and keeping qualities of cream; homogenisation of cream.

Pasteurisation of cream; cooling and storage; marketing of cream.

Cream preparations; whipped cream, clotted cream, sterilised cream, reconstituted cream.

Cream appliances, homogenisers, cream sterilising plant, pasteurisers, cream coolers.

Ice Cream.—Types of plant used. Materials used in, and preparation of mixes. Pasteurising, ripening, freezing, and hardening.

Butter.—Production and consumption of butter in Great Britain; sources of imports.

Food value of butter; regulations governing the production and sale of butter.

Selection and grading of cream for butter-making.

Treatment of cream prior to churning; heating, cooling; preparation and use of starters.

Churning of cream; factors affecting churning and loss of butter fat.

Washing of butter; purity of wash water.

Methods of working and salting of butter; quality of salt.

Packing of butter and treatment of liners and butter boxes; storage of butter; refrigeration in factories and in transport.

Grading and judging butter. National Mark butter. Common defects in butter and their causes.

Special systems of butter-making; sweet cream butter; whole milk butter; neutralised cream butter; whey butter.

Utilisation of by-products of butter-making; separated milk and butter milk. Casein.

Butter-making equipment; separators; pasteurising plant, cream coolers, cream pumps, starter-preparing apparatus, cream ripeners, churns and butter workers. Butter packers, moulders and blenders, butter cutting, and wrapping machines.

IV.—CHEESE AND CHEESE PRODUCTS.

Production and consumption of cheese in Great Britain; sources of imports.

Food values of cheese.

Principles of cheese-making; varieties of cheese.

Hard-pressed cheese. Agents used in manufacturing process; starter, colour, rennet, salt.

Milk for cheese-making; care and management.

Detailed knowledge of the manufacture of Cheddar and Cheshire, and one of the following: Derby, Dunlop, Leicester, Gloucester, or Lancashire.

Manufacture of cheese from pasteurised milk.

Small hard-pressed cheeses: Caerphilly, Smallholder, &c.

Difficulties experienced in the manufacturing process; causes of fast and slow working, gas formation, ropy and slimy whey.

Ripening and storage of cheese.

Grading and judging of cheese; National Mark standards.

Marketing of cheese.

Defects in the flavour, body, and texture, and in the colour of mature cheese.

Manufacture of Stilton and Wensleydale cheeses, blue-veined and white.

Soft cheese-making.

Cream cheeses. Single and double cream cheeses.

Cheese products. Manufacture of processed cheese, and cheese spreads.

Usual cheese factory equipment and arrangement; cheese vats, curd knives, curd agitator, cheese press, curd mill; cheese hoops, cheese turners, paraffining apparatus, pasteurising equipment, air conditioning plant.

Utilisation of whey.

V.—DAIRY CHEMISTRY.

The principal constituents of foodstuffs and the functions they fulfil. Assimilation and digestion. Vitamins.

The nature and composition of milk, colostrum, butter, cheese, cream, separated milk, butter milk, whey, casein, and lactose.

Drying and condensation of milk and milk products.

Variation in composition of milk.

Milk souring, rennet coagulation, preparation and ripening of cheese, storage of butter, salt for dairy purposes.

Metals and their influence on milk and milk products. Taints. Effects of heat on milk. Abnormal milk.

The sampling and analysis of milk and milk products. Freezing point test for milk.

Commercial routine analysis of foodstuffs.

Chemical aspects of water supply.

Dairy detergents and disinfectants.

N.B.—*Candidates are required to bring to the Oral Examination in this subject their Laboratory notebooks certified by their teachers as being the record of their Laboratory work carried out during the course.*

VI.—DAIRY MICROBIOLOGY.

GENERAL.—The bacteria, yeasts, and moulds which commonly occur in milk and dairy products; their form, classification (in the case of the bacteria—Topley and Wilson's), growth and reproduction. Factors which control rate of growth. Fermentations of importance in dairying; causal micro-organisms and conditions which influence activity.

MILK.—Microbiology of milk production; sources of contamination, their relative importance and organisms derived from them. Normal changes produced by micro-organisms in milk. Abnormal changes; ropiness, premature curdling, gas formation, bitter, yeasty and malty flavours and flavour of roots and feeding-stuffs; causal organisms and methods of prevention. Effects of straining, centrifuging, cooling, heating, condensing, drying, and preservatives on the microflora of milk. Bacteriology of pasteurised and sterilised milk; influence of quality of raw milk. Standards for graded milks.

MILK PRODUCTS.—Starters; their propagation and management. Ripening of cream; development of normal flavour. Microbiology of butter. Ripening of hard, soft, and blue-veined cheese; factors concerned and their control. Microbiology of condensed, dried, and fermented milks. Defects of dairy products, causal organisms and preventive measures; butter defects—rancidity, yeasty and cheesy flavours, coloured spots; cheese defects—gas formation, bitterness, slow acid development and excessive acidity, colour changes; defects of condensed milk—gas formation, "buttons," coagulation.

DISEASES.—Diseases which may be conveyed by milk; sources of infection. Bacteriology of tuberculosis, contagious abortion, mastitis and methods of detection. Immunity; vaccines. Disinfection.

WATER.—The importance of a pure water supply for the dairy and the herd. Bacteria commonly present in natural waters. Sources of contamination, the effect of pollution with sewage, water-borne disease.

LABORATORY WORK.—The microscope and its use. Staining (including Gram and Ziehl-Neelsen methods), and microscopic examination of micro-organisms. Methods of isolation and cultivation. Preparation of bile-salt broth, milk, milk agar, and Wilson's agar. Methods for the examination of milk; plate method, post-pasteurisation count, coliform test, Breed's method and the methylene blue reduction, fermentation, acidity and catalase tests. Methods for tracing sources of contamination and of milk faults. Detection of thermophilic, thermoduric, and pathogenic organisms in milk. Examination of water supplies.

N.B.—*Candidates are required to bring to the Oral Examination in this subject their Laboratory notebooks certified by their teachers as being the record of their Laboratory work carried out during the course.*

VII.—DAIRY BOOK-KEEPING.

Reasons for keeping accounts on the farm and in the dairy factory.

General principles of double-entry book-keeping. Use of day-book, journal, ledger, cash-book, and petty-cash book. Preparation of profit and loss account, capital account, and balance-sheet. Adjustments necessary for the owner-occupier.

Analysis cash-book.

Valuations.—Basis of valuations for accounting purposes on the farm and in the dairy factory. Dates for stock-taking.

Methods of accounting suitable for dairy farms with varying systems of milk disposal.

Opening a bank account. Cheques, deposits, and overdrafts.

Assessment of the farmer for Income Tax purposes.

WINNERS OF DIPLOMA IN 1941.

SCOTTISH CENTRE.

(All the candidates at the Scottish Centre had been students at the Dairy School for Scotland, Auchincruive, Ayr.)

Diploma.

DONALD GRANT ANDERSON, 10 East Mount Road, Darlington.
AMY AYLES, Ardvreck, 65 Fullarton Drive, Troon, Ayrshire.
EILEEN MARY CATHERINE COWIESON, Pitmedden Poultry Farm, Udny, Aberdeenshire.
ANNIE ANDERSON CURSITER, Braeside, Stenness, Kirkwall, Orkney.
CATHERINE DRIFE, Knockenstob Farm, Sanquhar, Dumfriesshire.
ANDREW BALFOUR DUNCAN, Homefield, 23 Craigie Road, Ayr.
NORAH FRANCES HALL, Henderson Hall, Cochrane Park, Newcastle-upon-Tyne.
WILLIAM JOHNSON, 5 St John's Terrace, Dipton, Newcastle-upon-Tyne.
KATHERINE KERR, Parkfield, Styal, Cheshire.
CATRIONA MARY MACKENZIE, 2 Cameron Crescent, Edinburgh 9.
REBA IRWIN PEVIE, 35 Orchard Park Avenue, Giffnock, Renfrewshire.
GERTRUDE ANN SEATON, Lime Grove, Stokesley, Middlesborough, Yorks.
WILLIAM FRASER STEPHEN, 18 Orleans Avenue, Glasgow, W 4.
ELIZABETH YOUNG STEVEN, Banniskirk, Halkirk, Caithness.
AGNES THOMSON STEWART, Brae Cottage, Auchendrane Estate, by Ayr.
MARGARET JESSIE JEAN SUTHERLAND, Gunnista, Bressay, Lerwick, Shetland.
HELEN LOCKE WATSON, West Arthurlie, Barrhead, by Glasgow.
JOHN OLDHAM WOLSTENHOLME, 241 Chamber Road, Oldham, Lancs.

ENGLISH CENTRE.

Diploma.

JEAN CARR ABBOTT, Midland Agricultural College, Sutton Bonington, Loughborough.
MARGARET BELTON, Midland Agricultural College, Sutton Bonington, Loughborough.
MARY ELIAZBETH BLORE, Midland Agricultural College, Sutton Bonington, Loughborough.
ROSEMARY JEAN BOAZ, The University and British Dairy Institute, Reading.
ROBERT JAMES BRACEGIRDLE, Midland Agricultural College, Sutton Bonington, Loughborough.
SHEILA AGNES DIXON, University College of Wales, Aberystwyth.
MARY IFONWY EVANS, University College of Wales, Aberystwyth.
JEAN MARY CAMPBELL FAILL, The University and British Dairy Institute, Reading.

RUTH FOLLETT, Studley College, Warwickshire.

JOY DESIRÉE GANE, The University and British Dairy Institute, Reading.

OLWEN ELUNED HIGGS, The University and British Dairy Institute, Reading.

DOROTHY MASON, Midland Agricultural College, Sutton Bonington, Loughborough.

DIANA MARY MEESON, The University and British Dairy Institute, Reading.

MARJORIE MILLS, The University and British Dairy Institute, Reading.

KENNETH JOHN MORGAN, University College of Wales, Aberystwyth, and British Dairy Institute, Reading.

ANNE CHRISTINE NOWILL, Midland Agricultural College, Sutton Bonington, Loughborough.

LOUIE PATRICK, The University and British Dairy Institute, Reading.

MARY PENTY, The University and British Dairy Institute, Reading.

JILL STEPHANIE RAMSDEN, The University and British Dairy Institute, Reading.

HAROLD TAYLOR, Lancs. County Institute of Agriculture, Hutton, Preston.

MARY ISABEL THOMAS, The University and British Dairy Institute, Reading.

DORIS LORNA TRUE, Midland Agricultural College, Sutton Bonington, Loughborough.

ARTHUR ERIC WILSON, Midland Agricultural College, Sutton Bonington, Loughborough..

MARY ELIZABETH WRIGHT, The University and British Dairy Institute, Reading.

EXAMINATION PAPERS OF PAST YEARS.

Copies of papers set at past Examinations in Dairying may be had on application. Price 6d. per set. Papers available are those for the years 1937-1941 inclusive.

CERTIFICATES IN FORESTRY

In 1870 the Society instituted an Examination in Forestry, and granted First and Second-Class Certificates respectively to such students as attained a certain standard of proficiency in the following subjects. Candidates were required to possess a thorough acquaintance with the theory and practice of Forestry, and a general knowledge of the following branches of study, so far as these applied to Forestry: (*a*) the elements of Forest Botany and Forest Zoology: (*b*) the elements of Meteorology and Geology; (*c*) Forest Engineering; and (*d*) Arithmetic and Book-keeping.

Holders of the First-Class Certificate were entitled to become free Life Members of the Society.

In view of the institution of Examinations for Certificates and Diplomas in Forestry by the Royal Scottish Forestry Society, and by arrangement with that Society, the Board of Directors of the Highland and Agricultural Society of Scotland resolved in 1935 to cease holding further Examinations for the First and Second-Class Certificates, and that, in future, the granting of Certificates and Diplomas be left in the hands of the Royal Scottish Forestry Society.

The list of students who obtained the Highland and Agricultural Society's Certificates in Forestry prior to 1899 appears in the 'Transactions' for the year 1899. A further list of those obtaining Certificates between 1899 and 1935 inclusive appears in the 'Transactions' for the year 1935. The total number of Certificates granted since the commencement of the Examination in 1870 was as follows: First-Class, 43; Second-Class, 38.

VETERINARY CERTIFICATES AND MEDALS

The Society established a Veterinary Department in 1823, but by an arrangement made with the Royal College of Veterinary Surgeons, the Society's examination ceased in 1881. Holders of the Society's Veterinary Certificate are entitled to become members of the Royal College of Veterinary Surgeons on payment of certain fees, without being required to undergo any further examination. The number of students who passed for the Society's Certificate is 1183.

The Society gives annually a limited number of silver medals for Class competition to each of the two Veterinary Colleges in Scotland —the Royal (Dick) Veterinary College, Edinburgh, and the Glasgow Veterinary College, Glasgow

ENTOMOLOGICAL DEPARTMENT

Consulting Zoologist to the Society—A. E. Cameron, M.A., D.Sc., Department of Agricultural and Forest Zoology, University of Edinburgh, 10 George Square, Edinburgh.

REPORTS ON THE ANIMAL ENEMIES OF CROP PLANTS AND LIVE STOCK (INCLUDING POULTRY).

The Consulting Zoologist is prepared to send to any Member of the Society a Report on damage to, or diseases of, plants and animals due to animal agency (Insects, Mites, Worms, Snails, Slugs, Birds, and the Smaller Mammals), and will advise Members regarding insects or allied animals which, in any stage of their development, infest—

(*a*) Farm crops.
(*b*) Stored grain and foodstuffs.
(*c*) Garden and greenhouse plants.
(*d*) Fruit and fruit trees.
(*e*) Forest trees and stored timber.
(*f*) Live stock (including poultry).

Any Member consulting Dr Cameron should give him full particulars of the damage or disease upon which his advice is desired. In addition, there should be sent to him specimens of the injured plants, or the injured parts of plants, &c., as well as specimens of the insects or animals believed to be the cause of the injury.

Specimens should be sent in tin or wooden boxes, or in quills, in order to prevent injury in transmission.

The Directors have fixed the fee payable by Members to Dr Cameron at 2s. 6d. for each case upon which he is consulted: this fee should be sent to him along with the application for information.

Letters and parcels (carriage or postage paid) should be addressed to A. E. Cameron, Esq., M.A., D.Sc., Department of Agricultural and Forest Zoology, University of Edinburgh, 10 George Square, Edinburgh.

CHEMICAL DEPARTMENT

Chemist to the Society—J. F. Tocher, D.Sc., LL.D., F.I.C.,
Crown Mansions, 41½ Union Street, Aberdeen.

The object of the Chemical Department is to promote the diffusion of a knowledge of Chemistry as applied to agriculture among the members of the Society, to carry out experiments for that purpose, to assist members who are engaged in making local experiments requiring the direction or services of a chemist, to direct members in regard to the use of manures and feeding-stuffs, to assist them to put the purchase of these substances under proper control, and in general to consider all matters coming under the Society's notice in connection with the Chemistry of Agriculture.

MEMBERS' PRIVILEGES IN RESPECT TO ANALYSES.

The Directors are anxious to take any steps in their power to expose the vendors of inferior fertilisers and feeding-stuffs, and the members can give them assistance in this by supplying to the Chemist, when sending samples for analysis, information as to the guarantee, if any, on which the goods were sold, and also as to the price charged.

These charges apply only to analyses made for agricultural purposes, and for the sole and private use of members of the Highland and Agricultural Society who are not engaged in the manufacture or sale of the substances analysed.

Valuations of manures, according to the Society's scale of units, will be supplied if requested.

The Society will not be liable for payment of fees in respect of analyses for any member in excess of £5 for any one year, or £10 for any five consecutive years.

The undernoted fees are those payable by a member. These amounts represent only one-third of the total fee for any particular analysis, the other two-thirds being paid by the Society.

This scale does not apply to members whose subscriptions are in arrears.

Fertilisers and Feeding-Stuffs.

(1) The determination of one ingredient in a single sample of a *manure* or of a *feeding-stuff*	3/6
(2) The determination of two ingredients in a single sample of a *manure* or of a *feeding-stuff*	5/-
(3) The complete analysis of a sample of a *manure* or of a *feeding-stuff*	10/-

For example—

For one ingredient only.

Linseed and other cakes, for oil *or* for albuminoids	3/6
Feeding meals, ground cereals, for oil *or* for albuminoids	
Bone meals, for nitrogen *or* for total phosphate	
Compound manures, for nitrogen *or* for soluble phosphate *or* for insoluble phosphate *or* for potash	
Superphosphate, for soluble phosphate *or* for insoluble phosphate	
Ground mineral phosphate, for insoluble phosphate *or* for citric soluble phosphate	
Slag phosphate, for insoluble phosphate *or* for citric soluble phosphate	

For two ingredients only.

Any two ingredients of a manure or of a feeding-stuff	5/-

For a complete analysis.

For manures, the proportions of nitrogen (nitrogen included as nitrates or as ammonia compounds), soluble phosphate, insoluble phosphate, potash; *For feeding-stuffs*, the proportions of oil, albuminoids, carbohydrates, iodine, mineral matter, fibre and moisture	10/-

(4)	Ground Limestone, for carbonic acid and calcium, two determinations	5/-
(5)	Ground Lime, for percentage of calcium oxide	3/6

AGRICULTURAL PRODUCTS.

(6)	Turnips, sugar beet, for total sugar	5/-
(7)	Turnips, sugar beet, for oil, albuminoids, sugar, mineral matter, fibre and moisture	10/-
(8)	Grass, hay, ensilage, grain, &c., for oil, albuminoids, carbohydrates, mineral matter, fibre and moisture	10/-
(9)	Grain, for carbohydrates and moisture	5/-

MILK AND MILK PRODUCTS.

(10)	*Milk*, fresh, for butter fat only, by Gerber process	1/-
(11)	*Milk*, fresh, for butter fat, by Gerber, and solids not fat	2/6
(12)	*Milk*, sour sample, for butter fat, and solids not fat. Soxhlet extraction and Government Laboratory method for sour sample	5/-
(13)	*Milk*, for preservatives, borates, sulphur dioxide, hydrogen peroxide, formalin	5/-
(14)	*Butter*, for true butter fat and moisture (Reichert), for genuineness	5/-
(15)	*Butter*, for true butter fat (Reichert), moisture, foreign fat, preservatives	7/6

WATER AND LIQUID SUBSTANCES.

Cases containing bottles for water samples and instructions for sampling are sent from the laboratory on application.

(16)	Supply of water at farm, for total solids, free ammonia, albuminoid ammonia, nitrites, nitrates, hardness, for fitness for domestic use or potability . .	12/6
(17)	Supply of water at farm, for potability as above, and for proportions of mineral constituents, lead, copper, acidity pH value, action of water on lead (plumbo solvency), action of water on copper .	£1
(18)	Farm-yard manure, liquid manure, for nitrogen, potash, phosphates, and proportion of other mineral substances	£1

MISCELLANEOUS.

(19)	Feeding oils and fats, for composition and quality .	10/-
(20)	Search for proportion of arsenic in feeding-stuff . .	10/-
(21)	Search for proportion of lead in feeding-stuff . .	10/-
(22)	Search for arsenic or any one poison in feeding-stuff .	10/-
(23)	Search for proportion of any one poison in viscera .	10/-
(24)	Search for poisons in food or in viscera, and proportion of poison found	£1 10/-

(Veterinary surgeons are not entitled to have searches made for poisons in food or viscera under the Society's scheme for clients who are not members of the Society.)

(25)	Proportion of arsenic in sheep dips or insecticides .	10/-
(26)	Proportion of carbolic acid in sheep dips or insecticides	5/-
(27)	Proportion of tar acids in sheep dips or insecticides .	10/-
(28)	Insecticides, foot rot pastes and other agricultural remedies for live stock and farm produce . .	£1

Samples should be sent (carriage paid) to DR J. F. TOCHER, *Crown Mansions, 41½ Union Street, Aberdeen.*

INSTRUCTIONS FOR SELECTING SAMPLES FOR ANALYSIS.

MANURES.

Any method of sampling mutually agreed upon between buyer and seller may be adopted, but the following method is recommended as a very complete and satisfactory one: Four or more bags should be selected for sampling. Each bag is to be emptied out separately on a clean floor, worked through with the spade, and one spadeful taken out and set aside. The four or more spadefuls thus set aside are to be mixed together until a uniform mixture is obtained. Of this mixture one spadeful is to be taken, spread on paper, and still more thoroughly mixed, any lumps which it may contain being broken down with the hand. Of this mixture two samples of about half a pound each should be taken by the purchaser or his agent, in the presence of the seller or his agent or two witnesses (due notice having been given to the seller of the time and place of sampling), and these samples should be taken as quickly as possible, and put into bottles or tin cases to prevent loss of moisture, and having been labelled, should be sealed by the samplers—one or more samples to be retained by the purchaser, and one to be sent to the Chemist for analysis.

FEEDING-STUFFS.

Samples of feeding-stuffs which are in the form of meal may be taken in a similar manner to that mentioned above.

Samples of cake should be taken by selecting four or more cakes from the bulk. These should be nutted to a size not larger than walnuts. The nutted cake should then be thoroughly mixed and samples of not less than one pound each taken from it. The samples should be put into bottles or tins, sealed up, and labelled. One sample should be sent to the Chemist, and one or more duplicates retained by the purchaser.

VEGETABLE PRODUCTS.

Turnips, &c., at least 50 bulbs carefully selected as of fair average growth.

Hay, straw, ensilage, &c., should be sampled from a thin section cut across the whole stack or silo, and carefully mixed; above 2 lb. weight is required for analysis.

Grain should be sampled like manures.

Grass should be representative of the whole field; about 5 lb. weight is required for analysis.

DAIRY PRODUCE.

Milk.—Samples of milk from individual cows should be taken direct from the milk-pail after complete milking. Average samples from a number of cows should be taken immediately after milking. Specify whether the sample is morning or evening milk, or a mixture of these. Samples to be tested for adulteration should not be drawn from the bottom or taken from the top of standing milk, but they should be ladled from the vessel after the milk has been thoroughly mixed. Samples of milk should be sent immediately to the Chemist.

For most purposes a half-pint bottle of milk is a large enough sample.

Butter.—About quarter-pound samples are required.

WATERS.

When the water is from a well, it should be pumped for some minutes before taking the sample.

If the well has been standing unused for a long time, it should be pumped for some hours, so that the water may be renewed as far as possible.

If the well has been newly dug or cleaned out, it should be pumped as dry as possible, daily, for a week before taking the sample.

Water from cisterns, tanks, ponds, &c., should be sampled by immersing the bottle entirely under the water, and holding it, neck upwards, some inches below the surface. *Water from the surface should not be allowed to enter the bottle.*

Spring or stream water should not be sampled in very wet weather, but when the water is in ordinary condition. Such waters should be sampled by immersing the bottle. If not deep enough for that purpose, a perfectly clean cup should be used for transferring the water to the bottle.

When the bottle has been filled the stopper should be rinsed in the water before replacing it.

Interference with or disturbance of wells or springs, or the ground in their immediate vicinity, must be carefully avoided during sampling, and for at least twenty-four hours before it.

After a sample has been taken, it should be sent to the Chemist as speedily as possible.

A description of the source and circumstances of the water should accompany the sample, as the interpretation of the analytical results depends to some extent on a knowledge of such particulars.

N.B.—Stone jars and old wine bottles are unsuitable for conveying samples. Winchester quarts chemically cleaned should be obtained from Dr J. F. Tocher, Crown Mansions, 41½ Union Street, Aberdeen.

COMPOSITION AND CHARACTERISTICS OF MANURES AND FEEDING-STUFFS.

Note on Statutory Statements.

In the Fertilisers and Feeding Stuffs Act, 1926, are included certain schedules which give the definitions implied on the sale of fertilisers and feeding-stuffs under certain names and also the particulars to be contained in the statutory statement which has to be furnished to the purchaser in connection with the sale of a fertiliser or a feeding-stuff. Such statutory statements "shall have effect as a written warranty by the seller that the particulars contained in the statutory statement are correct."

The particulars required vary for different articles and the undernoted are given as examples. Full particulars can be found by reference to the schedules of the Act.

FERTILISERS.

Sulphate of ammonia . .	Amount of nitrogen and amount of free acid.
Superphosphate	Amount of soluble phosphoric acid.
Potassium salts (potash fertilisers)	Amount of potash.
Compound fertilisers . .	Amounts of nitrogen, potash, soluble phosphoric acid, and insoluble phosphoric acid, if any, respectively.

FEEDING-STUFFS.

Linseed cakes and the meals of such cakes.	Amounts of oil and albuminoids.
Cotton cakes or meals (not decorticated).	Amounts of oil and albuminoids.
Cotton cakes or meals from decorticated or partly decorticated cotton seed.	Amounts of oil, albuminoids, and fibre.
Compound cakes or meals . .	Amounts, if any, of oil, albuminoids, and fibre.

PRICES OF FERTILISERS AND FEEDING-STUFFS—SEASON 1942.

(Cash Prices as at 4th February. These prices are subject to variation from month to month or oftener.)

FERTILISERS.

Name of Fertiliser.	Guarantee.	Price per Ton.			Price per Unit.	
		£	s.	d.	s.	d.
Superphosphate	18% Sol. P.A. =39·3% Tric. Phos.	4	19	0	5	6
Sulphate of Ammonia (neutral) *	20·6 % Nitrogen	10	0	6	9	8¾
,, ,, (March-June)	,,	10	2	0	9	9¾
Basic Slag *†	12 % Total Phos. Acid =26·2 % Tric. Phos.	2	12	6	4	4¼
,, ,, *†	13 % Total Phos. Acid =28·4 % Tric. Phos.	2	15	6	4	3¼
,, ,, *†	14 % Total Phos. Acid =30·6 % Tric. Phos.	2	18	6	4	2¼
,, ,, *‡ (Bessemer)	18·3 % Total Phos. Acid. =40 % Tric. Phos.	3	12	6	3	11½
Bone Meal (Indian)	4 % Nit. 20 % Total Phos. Acid =43·7 % Tric. Phos.	13	10	0	N 30 TPA 7	0 6
Ground Mineral Phosphate §	35 % Total Phos. Acid =76·3 % Tric. Phos.	5	17	6	3	4¼
Nitrate of Soda (at Leith) *	16 % Nitrogen	10	14	0	13	4½
Chilean Potash Nitrate *	15 % ,, 15 % Potash	15	15	0	N 14 P 7	0 0
Nitro Chalk *	15·5 % Nitrogen	9	14	0	12	6¼
Potash Salts	30 % Potash	7	3	6	4	9½
Sulphate of Potash	48·5 % ,,	18	15	0	7	8¾
Muriate of Potash	50 % ,,	11	10	0	4	7¼
Concentrated Fertiliser ‖	14 % Nitrogen 14 % Sol. P.A. 10 % Potash	15	6	3	N 11 SPA 6 Pot. 5	8 7½ 7½

The prices for all fertilisers are cash prices for two-ton lots in bags at Leith or Glasgow, unless otherwise stated. Where prices are quoted carriage paid, there is a reduction, in certain cases, of from 5/- to 10/- per ton when lifted Ex Sellers' stores.

* Carriage paid to any railway station in six-ton lots. Four-ton lots 1/- more per ton.

† The fineness is such that 80% of the powder will pass through the prescribed sieve. 1/- more per ton if solubility guaranteed.

‡ The fineness is such that 90% of the powder will pass through the prescribed sieve. 85% solubility in citric acid.

§ The fineness is such that 50 % of the powder will pass through the prescribed sieve.

‖ Price for 6 ton lots including cost of mixing, &c.

N.B.—When these units are multiplied by the percentages in the analysis of a Manure, they will produce a value representing very nearly the cash price *per ton at which Fertilisers may be bought in fine sowable condition at Leith or Glasgow.*

Ground Lime, in bags (65 % calcium oxide), at Dufftown, 51/6 per ton; (60 % calcium oxide), at Grange, 51/6 per ton; (60 % calcium oxide), at Fushiebridge, 47/6 per ton.

English Ground Lime (85 % calcium oxide), to Aberdeen, 65/9 per ton; (90% calcium oxide), to Aberdeen, 68/9 per ton.

English Ground Lime (95 % calcium oxide), at Buxton, f.o.r. 37/5 per ton, in bags; or to Edinburgh, 64/6 per ton; to Lanark, 62/- per ton; to Stirling, 67/5 per ton; to Dumfries, 59/7 per ton.

Ground Limestone (96 % calcium carbonate), at Buxton, f.o.r. in bags, 23/4 per ton; or to Edinburgh, 49/6 per ton; to Lanark, 46/- per ton; to Stirling, 50/9 per ton; to Dumfries, 44/6 per ton; to Aberdeen, 51/1 per ton; in six-ton lots in bags. 80 % passing through prescribed sieve.

FEEDING-STUFFS.

Name of Feeding-Stuff.	Price per Ton.		
	£	s.	d.
Linseed Cake (Home), 8% Oil, 28% Albuminoids	11	5	0
Linseed Cake (Expeller), 9% Oil, 30% Albuminoids	11	7	6
Cotton Seed Cake (Egyptian) (undecorticated) (home made), 4·5 % Oil, 22 % Albuminoids	7	17	6
Decorticated Cotton Seed Cake, 48-50% Oil and Albuminoids	10	2	6
Ground Nut Cake—			
Decorticated (Expeller), 48-50% Oil and Albuminoids *	9	10	0
Decorticated (Expeller), 57-60% Oil and Albuminoids	9	17	6
Rice Bran Meal*	8	5	0
White Bran, straight run	9	15	0
Red Bran, straight run	8	15	0
Fine Wheat Feed	8	15	0
Dried Grains § From	7	8	6
To	8	18	6
Feeding Treacle †	5	13	0
Locust Beans (Kibbled) *‡	9	12	6
Maize*§	10	0	0
,, (Flaked)*‡	12	2	6
Beans (Imported)*‡	15	7	6
Bean Meal*	16	15	0
Soya Bean Meal (extracted)*	12	7	6
Home Oats (Feeding)	15	0	0
White Fish Meal, 4% Oil, 64% Albuminoids (at Aberdeen)	23	9	4
Ground Barley*	15	15	9
Barley (Imported)	14	5	0

Prices are for one-ton lots direct *ex* import quay or mill, unless otherwise stated.

Controlled price. None available at this date. † In one-ton lots at Greenock. Casks or drums extra. ‡ Including Bags. § Bags extra.

CLASSIFICATION OF MANURES.

BONE MEALS	Genuine Bone Meal contains about 20 per cent Phosphoric Acid equal to 43·7 per cent Tricalcium Phosphate, and about 4 per cent Nitrogen. If Phosphates are low, Nitrogen will be high, and conversely.
MIXTURES AND COMPOUND MANURES	To be valued according to the following units: Nitrogen, 9/10; Soluble Phosphoric Acid, 5/9½; Insoluble Phosphoric Acid, 3/5; and Potash, 4/11 (from muriate). The value so arrived at will be the value at Leith or Glasgow, exclusive of the cost of mixing, bags and bagging, which may be taken on an average at about 30/- per ton.

INSTRUCTIONS FOR VALUING MANURES.

The unit used for the valuation of manures is the hundredth part of a ton, and as the results of analyses of manures are expressed in parts per hundred, the percentage of any ingredient of a manure when multiplied by the price of the unit of that ingredient represents the value of the quantity of it contained in a ton.

As an example take muriate of potash; a good sample (see p. 44) will be guaranteed to contain 50 per cent of oxide of potash. All potash manures are valued according to the amount of potash (oxide of potash) they yield, and muriate of potash yields 50 per cent of potash (K_2O)—*i.e.*, 50 units per ton; and as a ton of muriate of potash costs £11, 10s., the price of the unit is the fiftieth part of that—viz., 4/7¼. If on analysis a sample of muriate of potash guaranteed to contain 50 per cent of potash is found to contain only 47 per cent, the price per ton will be 13/10 (three times 4/7¼) less—viz., £10, 16s. 2d.

Similarly with all other manures, the price per unit is derived from the price per ton of a sample of good material up to its guarantee, and therefore the proper price per ton of a manure is found by multiplying the price of the unit of the valuable ingredient by the percentage, as found by analysis. If a manure contains more than one valuable ingredient, the unit value of each ingredient is multiplied by its percentage, and the values so found when added together give approximately the price per ton of the manure.

The commercial values of manures are determined by means of the Units in the following manner:—

Take the results of analysis of the manure, and look for the following substances:—

Phosphates dissolved (or soluble phosphoric acid)
Phosphates undissolved (or insoluble phosphoric acid)
Total phosphoric acid
Nitrogen
Potash

No other items but these are to be valued.

Should the results of analysis or the guarantee not be expressed in that way, the chemist or the seller should be asked to state the quantities in these terms.

Suppose the manure is ground mineral phosphate—

The proportion of phosphate present in a sample guaranteed to contain 35 per cent phosphoric acid may be 32 per cent phosphoric acid. The price per unit of phosphoric acid in ground mineral phosphate (35 per cent grade) is 3s. 4½d. The value of ground mineral phosphate containing 32 per cent phosphoric acid is therefore 32 times 3s. 4½d., equal to £5, 7s. 4d.

Suppose the manure is a superphosphate. The price per unit of phosphoric acid in superphosphate (18 per cent grade) is 5/6, and if a consignment contains 17 per cent soluble phosphoric acid it is valued thus—

Soluble phosphoric acid. 17 times 5/6, equal to £4, 13s. 6d.

Insoluble phosphoric acid is not valued in a superphosphate.

Suppose the manure is a compound fertiliser containing 6 per cent nitrogen, 8 per cent soluble phosphoric acid, 1 per cent insoluble phosphoric acid, and 5 per cent potash. From the units given on p. 45 for "Mixtures and Compound Manures," the value of this compound fertiliser is obtained as follows:—

The value of the—

Nitrogen will be	. £2	19	0	per ton
Soluble phosphoric acid will be .	. 2	6	4	,,
Insoluble phosphoric acid will be	. 0	3	5	,,
Potash will be	. 1	4	7	,,
	£6	13	4	

The value of this manure will thus be £6, 13s. 4d. per ton, exclusive of the cost of mixing, bags and bagging, which may be taken on an average at about 30/- per ton. It will be seen that the potash is valued on the assumption that it is derived from muriate.

Note.—The units have reference solely to the Market Prices of Manures, and not to their Agricultural Values.

TABLE OF COMPENSATION VALUES FOR 1942.

TABLE SHOWING THE VALUE OF FEEDING-STUFFS AS MANURE PER TON, AND THE COMPENSATION VALUE PER TON OF FOOD CONSUMED, BASED ON THE AVERAGE UNIT PRICES OF FERTILISERS FOR 1942.

The following is a Table showing (under Section A) the average proportions of nitrogen, phosphoric acid, and potash present in the feeding-stuffs named. The Table also shows the value per unit of nitrogen, phosphoric acid, and potash, the prices per unit being the value per unit for compound manures prevailing for 1942. Under Section B of the Table is shown the compensation value per ton of food consumed for each of the feeding-stuffs named, based on the unit prices for 1942. Column (1) of Section B of the Table shows the value per ton recovered in dung; while the remaining two columns show the residual values per ton after one crop and two crops have been removed.

The residual value, after one crop has been removed, is taken as one-half of the original residual value. Residual values, after one crop has been removed, are reduced by one-half after each crop.

Foods.	Nitrogen.		
	Per cent in food. (1)	Value at 9s. 10d. per unit. (2)	Two-fifths value to manure. (3)
		s. d.	s. d.
Cotton-cake, decorticated	6·90	67 10	27 2
Cotton-cake, undecorticated	3·54	34 10	13 11
Linseed-cake	4·75	46 9	18 8
Linseed	3·60	35 5	14 2
Soya-bean cake	6·85	67 4	26 11
Palm-nut cake	2·50	24 7	9 10
Cocoa-nut cake	3·40	33 5	13 4
Earth-nut cake	7·62	74 11	30 0
Rape cake	4·90	48 2	19 3
Beans	4·00	39 4	15 9
Peas	3·60	35 5	14 2
Wheat	1·80	17 8	7 1
Barley	1·65	16 3	6 6
Oats	2·00	19 8	7 10
Maize	1·70	16 9	6 8
Rice-meal	1·90	18 8	7 6
Locust beans	1·20	11 10	4 9
Malt	1·70	16 9	6 8
Malt culms	3·90	38 4	15 4
Bran	2·50	24 7	9 10
Brewers' and distillers' grains (dried)	3·30	32 5	13 0
Brewers' and distillers' grains (wet)	0·81	8 0	3 2
Dried distillery dreg	5·31	52 3	20 11
Clover hay	2·24	22 0	8 10
Meadow hay	1·50	14 9	5 11
Wheat straw	0·45	4 5	1 9
Barley straw	0·40	3 11	1 7
Oat straw	0·50	4 11	2 0
Mangolds	0·22	2 2	0 10
Swedes	0·25	2 6	1 0
Turnips	0·18	1 9	0 8
Fish-meal	8·98	88 4	35 4

The figures in column (10) are the

A. Value per ton as Manure.										B. Compensation Value per ton of Food consumed.					
Phosphoric Acid.					Potash.					(1) Value recovered in dung. (10)		Residual Value after			
Per cent in food. (4)	Value at 5s. 9d. per unit. (5)		Three-fourths value to manure. (6)		Per cent in food. (7)	Value at 4s. 11d. per unit. (8)		Three-fourths value to manure. (9)				(2) One crop. (11)		(3) Two crops. (12)	
	s.	d.	s.	d.		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
3·10	17	10	13	5	2·00	9	10	7	5	48	0	24	0	12	0
2·00	11	6	8	8	2·00	9	10	7	5	30	0	15	0	7	6
2·00	11	6	8	8	1·40	6	11	5	2	32	6	16	3	8	2
1·54	8	10	6	8	1·37	6	9	5	1	25	11	13	0	6	6
1·30	7	6	5	8	2·20	10	10	8	2	40	9	20	5	10	2
1·20	6	11	5	2	0·50	2	6	1	11	16	11	8	6	4	3
1·40	8	1	6	1	2·00	9	10	7	5	26	10	13	5	6	9
2·00	11	6	8	8	1·50	7	5	5	7	44	3	22	2	11	1
2·50	14	5	10	10	1·50	7	5	5	7	35	8	17	10	8	11
1·10	6	4	4	9	1·30	6	5	4	10	25	4	12	8	6	4
0·85	4	11	3	8	0·96	4	9	3	7	21	5	10	9	5	4
0·85	4	11	3	8	0·53	2	7	1	11	12	8	6	4	3	2
0·75	4	4	3	3	0·55	2	8	2	0	11	9	5	11	2	11
0·60	3	5	2	7	0·50	2	6	1	11	12	4	6	2	3	1
0·60	3	5	2	7	0·37	1	10	1	5	10	8	5	4	2	8
0·60	3	5	2	7	0·37	1	10	1	5	11	6	5	9	2	11
0·80	4	7	3	5	0·80	3	11	2	11	11	1	5	7	2	9
0·80	4	7	3	5	0·60	2	11	2	2	12	3	6	2	3	1
2·00	11	6	8	8	2·00	9	10	7	5	31	5	15	9	7	10
2·70	15	6	11	8	1·45	7	2	5	5	26	11	13	6	6	9
1·61	9	3	6	11	0·20	1	0	0	9	20	8	10	4	5	2
0·42	2	5	1	10	0·05	0	3	0	2	5	2	2	7	1	4
0·44	2	6	1	11	0·22	1	1	0	10	23	8	11	10	5	11
0·57	3	3	2	5	1·50	7	5	5	7	16	10	8	5	4	3
0·40	2	4	1	9	1·60	7	10	5	11	13	7	6	10	3	5
0·24	1	5	1	1	0·80	3	11	2	11	5	9	2	11	1	5
0·18	1	0	0	9	1·00	4	11	3	8	6	0	3	0	1	6
0·24	1	5	1	1	1·00	4	11	3	8	6	9	3	5	1	8
0·07	0	5	0	4	0·40	2	0	1	6	2	8	1	4	0	8
0·06	0	4	0	3	0·22	1	1	0	10	2	1	1	1	0	6
0·05	0	3	0	2	0·30	1	6	1	2	2	0	1	0	0	6
7·24	41	8	31	3	0·50	2	6	1	11	68	6	34	3	17	2

sum of columns (3), (6), and (9

BOTANICAL DEPARTMENT

Consulting Botanist to the Society—(vacant).

The Society has fixed the following scale of charges for the examination of plants and seeds for the *bona fide* and individual use and information of members of the Society (not being seedsmen), who are particularly requested, when applying to the Consulting Botanist, to mention the kind of examination required, and to quote its number as appearing in the undernoted Scale of Charges. The charge for examination must be paid at the time of application, and the carriage or postage on all parcels must be prepaid.

Scale of Charges for Examinations.

1.	A report on the purity, amount, and nature of foreign materials, and the germinating power of a sample of seed . .	1s.
2.	Determination of the species of any weed or other plant, or of any vegetable parasite, with a report on its habits and the means for its extermination or prevention . . .	1s.
3.	Report on any disease affecting farm crops . . .	1s.
4.	Determination of the species of any natural grass or fodder plant, with a report on its habits and pasture or feeding value	1s.

The Consulting Botanist's Reports are furnished to enable members—purchasers of seeds and corn for agricultural or horticultural purposes—to test the value of what they buy, and are not to be used or made available for advertising or trade purposes by seedsmen or otherwise.

Purchase of Seeds.

The purchaser should obtain from the vendor, by invoice or other writing, the proper designation of the seeds bought, with a guarantee of the percentage of purity and germination, and of its freedom from ergot, and in the case of clover, from the seeds of dodder or broom-rape.

It is strongly recommended that the purchase of *prepared mixtures* of seeds should be avoided. The different seeds should be purchased separately and mixed by the farmer: mixtures cannot be tested for germination.

The Sampling of Seeds.

The utmost care should be taken to secure a fair and honest sample. This should be drawn from the bulk delivered to the purchaser, and not from the sample sent by the vendor.

When legal evidence is required, the sample should be taken from the bulk, and placed in a sealed bag in the presence of a witness. Care should be taken that the sample and bulk be not tampered with after delivery, or mixed or brought in contact with any other sample or bulk.

At least one ounce of grass and other small seeds should be sent, and two ounces of cereals and the larger seeds. When the bulk is obviously impure the sample should be at least double the amount specified. Grass seeds should be sent at least four weeks, and seeds of clover and cereals two weeks, before they are to be used.

The exact name under which the sample has been sold and purchased should accompany it.

Reporting the Results.

The Report will be made on a schedule in which the nature and amount of impurities will be stated, and the number of days each sample has been under test, with the percentage of the seeds which have germinated.

"Hard" clover seeds, though not germinating within the time stated, will be considered good seeds, and their percentage separately stated.

The impurities in the sample, including the chaff of the species tested, will be specified in the schedule, and only the percentage of the pure seed of that species will be reported upon; but the REAL VALUE of the sample will be stated. The Real Value is the combined percentages of purity and germination, and is obtained by multiplying these percentages and dividing by 100: thus in a sample of Meadow Fescue having 88 per cent purity and 95 per cent germination, 88 multiplied by 95 gives 8360, and this divided by 100 gives 83·6, the Real Value.

Selecting Specimens of Plants.

The whole plant should be taken up and the earth shaken from the roots. If possible the plants should be in flower or fruit. They must be packed in a light box, or in a firm paper parcel.

Specimens of diseased plants or of parasites should be forwarded as fresh as possible. They must be placed in a bottle, or packed in tinfoil or oil-silk.

All specimens should be accompanied with a letter specifying the nature of the information required, and stating any local circumstances (soil, situation, &c.) which, in the opinion of the sender, would be likely to throw light on the inquiry.

NOTE.—Members are reminded that Seeds may now be tested at the Department of Agriculture for Scotland Seed-testing Station. Samples should be addressed to T. Anderson, Esq., Seed-testing Station, East Craigs, Corstorphine, Edinburgh.

PREMIUMS OFFERED

1942

GROUP I.—REPORTS.

GENERAL REGULATIONS.

1. It is to be distinctly understood that the Society is not responsible for the views, statements, or opinions of any of the writers whose papers are published in the 'Transactions.'

2. All reports must be legibly written, and on one side of the paper only; they must specify the number and subject of the Premium for which they are in competition; they must bear a distinguishing motto, and be accompanied by a sealed letter, similarly marked, containing the name and address of the reporter—initials must not be used.

3. No sealed letter, unless belonging to a report found entitled to the Premium offered, or a portion of it, will be opened without the author's consent.

4. Reports for which a Premium, or a portion of a Premium, has been awarded, become the property of the Society, and cannot be published in whole or in part, or circulated in any manner, without the consent of the Directors. All other papers will be returned to the authors if applied for within twelve months.

5. The Society is not bound to award the whole or any part of a Premium.

6. All reports must be of a practical character, containing the results of the writer's own observation or experiment, and the special conditions attached to each Premium must be strictly fulfilled. General essays, and papers compiled from books, will not be rewarded or accepted. Weights and measurements must be indicated by the imperial standards.

7. The Directors, before or after awarding a Premium, shall have power to require the writer of any report to verify the statements made in it.

8. The decisions of the Board of Directors are final and conclusive as to all matters relating to Premiums, whether for Reports or at General or District Shows; and it shall not be competent to raise any question or appeal touching such decisions before any other tribunal.

9. The Directors will welcome papers from any Contributor on any suitable subject, whether included in the Premium List or not; and if the topic and the treatment of it are both approved, the writer may be remunerated and his paper published.

SECTION 1.—THE SCIENCE AND PRACTICE OF AGRICULTURE.

FOR APPROVED REPORTS.

1. On any useful practice in Rural Economy adopted in other countries, and susceptible of being introduced with advantage into Scotland—The Gold Medal. To be lodged by 1st November in any year.

The purpose chiefly contemplated by the offer of this premium is to induce travellers to notice and record such particular practices as may seem calculated to benefit Scotland. The Report to be founded on personal observation.

2. Approved Reports on other suitable subjects. To be lodged by 1st November in any year.

SECTION 2.—ESTATE IMPROVEMENTS.

FOR APPROVED REPORTS.

1. By the Proprietor in Scotland who shall have executed the most judicious, successful, and extensive Improvement—The Gold Medal, or Ten Pounds. To be lodged by 1st November in any year.

Should the successful Report be written for the Proprietor by his resident factor or farm manager, a Minor Gold Medal will be awarded to the writer in addition to the Gold Medal to the Proprietor.

The merits of the Report will not be determined so much by the mere extent of the improvements, as by their character and relation to the size of the property. The improvements may comprise reclaiming, draining, enclosing, planting, road-making, building, and all other operations proper to landed estates. The period within which the operations may have been conducted is not limited, except that it must not exceed the term of the Reporter's proprietorship.

2. By the Proprietor or Tenant in Scotland who shall have reclaimed within the ten preceding years not less than forty

acres of Waste Land—The Gold Medal, or Ten Pounds. To be lodged by 1st November in any year.

3. By the Tenant in Scotland who shall have reclaimed within the ten preceding years not less than twenty acres of Waste Land—The Gold Medal, or Ten Pounds. To be lodged by 1st November in any year.

4. By the Tenant in Scotland who shall have reclaimed not less than ten acres within a similar period—The Medium Gold Medal, or Five Pounds. To be lodged by 1st November in any year.

The Reports in competition for Nos. 2, 3, and 4 may comprehend such general observations on the improvement of waste lands as the writer's experience may lead him to make, but must refer especially to the lands reclaimed—to the nature of the soil—the previous state and probable value of the subject—the obstacles opposed to its improvement—the details of the various operations—the mode of cultivation adopted—and the produce and value of the crops produced. As the required extent cannot be made up of different patches of land, the improvement must have relation to one subject; it must be of profitable character, and a rotation of crops must have been concluded before the date of the Report. *A detailed statement of the expenditure and return* and a certified measurement of the ground are requisite.

5. By the Proprietor or Tenant in Scotland who shall have improved within the ten preceding years the Pasturage of not less than thirty acres, by means of top-dressing, draining, or otherwise, without tillage, in situations where tillage may be inexpedient—The Gold Medal, or Ten pounds. To be lodged by 1st November in any year.

6. By the Tenant in Scotland who shall have improved not less than ten acres within a similar period—The Minor Gold Medal. To be lodged by 1st November in any year.

Reports in competition for Nos. 5 and 6 must state the particular mode of management adopted, the substances applied, the elevation and nature of the soil, its previous natural products, and the changes produced.

SECTION 3.—HIGHLAND INDUSTRIES.

FOR APPROVED REPORTS.

1. The best mode of treating native Wool; cleaning, carding, dyeing, spinning, knitting, and weaving by hand in the Highlands and Islands of Scotland—Five Pounds. To be lodged by 1st November in any year.

SECTION 4.—MACHINERY.

FOR APPROVED REPORTS.

To be lodged by 1st November in any year.

SECTION 5.—FORESTRY.

FOR APPROVED REPORTS.

1. On Plantations of not less than eight years' standing formed on deep peat-bog—The Medium Gold Medal, or Five Pounds. To be lodged by 1st November in any year.

The Premium is strictly applicable to deep peat or flow moss; the condition of the moss previous to planting, as well as at the date of the Report, should, if possible, be stated.

The Report must describe the mode and extent of the drainage, and the effect it has had in subsiding the moss—the trenching, levelling, or other preliminary operations that may have been performed on the surface—the mode of planting—kinds, sizes, and number of trees planted per acre—and their relative progress and value, as compared with plantations of a similar age and description grown on other soils in the vicinity.

GROUP II.—DISTRICT GRANTS.

APPLICATIONS.

Forms of Application may be obtained from the Secretary, 8 Eglinton Crescent, Edinburgh 12, which should be completed and returned on or before ***1st November 1942,*** in respect of a Grant commencing in the following year.

RENEWAL OF GRANT.—Applications for **renewal** of a particular Grant will be entertained only after the lapse of a specified interval of years (as undernoted) from the termination of the previous Grant, without prejudice, however, to the competency of applying in such intermediate years for a Grant in any other class.

Class.	Interval.
*1. Grants of £12 for Show Premiums for Horses, Cattle, Sheep, and Pigs	4 years.
2. Grants of £15 in respect of Stallions engaged for Agricultural purposes	3 years.
*3. Grants of Silver Medals in aid of Premiums . .	2 years.
4. Special Grants	—
5. Grants of £10 to Federations of S.W.R.I. for Show or Exhibition Prizes	2 years.

* NOTE.—*Grants under Classes* 1 *and* 3 *have been suspended for the duration of the War.*

CLASS 1.

LOCAL AGRICULTURAL SOCIETIES—GRANTS OF £12 FOR SHOW PREMIUMS FOR HORSES, CATTLE, SHEEP, AND PIGS.

REGULATIONS.—See Volume for 1940 for Regulations and Rules of Competition.

GRANTS SUSPENDED THROUGHOUT THE WAR.—In January 1941 the Directors agreed that it was undesirable for the Society to encourage the holding of Agricultural Shows during the War, and it was decided, accordingly, that all grants by the Society of money and medals in aid of Local Agricultural Shows be suspended throughout the further duration of the War.

The Societies entitled to grants at the end of the War on resumption of their Shows are detailed in the Volume for 1941.

CLASS 2.

HORSE ASSOCIATIONS — GRANTS OF £15 IN RESPECT OF STALLIONS ENGAGED FOR AGRICULTURAL PURPOSES.

REGULATIONS, 1942.

1. The Highland and Agricultural Society will make Grants to Horse Associations and other Societies in different districts engaging Stallions for agricultural purposes. The total sum expended by the Highland and Agricultural Society in such grants shall not exceed the sum of £210 in any one year.

(*Note.*—As a special provision this sum has been raised to £300 for the year 1942.)

2. All applications must be at the instance of a Horse Association. Either the Convener or the Secretary must be a member of the Highland and Agricultural Society of Scotland.

3. *Application of Grant.*—The portion of the Grant to any one Association or Society shall not exceed the sum of £15 in any one year. **It is intended that the Grant shall be used by the Association or Society for the purpose of enabling it to secure a better class of Stallion.**

4. *Duration of Grant.*—The Grant will continue for three consecutive years.

5. *Registration of Stallions.*—The Grants will be available only for Stallions which, for the years to which the Grants apply, are registered in the Register of Certified Draught Stallions published by the Department of Agriculture for Scotland. (For information regarding the Registration of Stallions, apply to the Secretary of the Department of Agriculture for Scotland, St Andrew's House, Edinburgh.)

6. *Engagement of Stallions.*—In the event of a Horse not being engaged in any one year while the provisions of the Grant are in force, the Grant made by the Highland and Agricultural Society will cease.

7. *Report to be Submitted.*—Forms of Report will be furnished to the Secretaries. Full details, as required, must be given and the completed Reports, duly signed and certified, must be lodged with the Secretary of the Highland and Agricultural Society as soon as possible, and in no case later than **1st November.** These Reports are subject to the approval of the Directors of the Highland and Agricultural Society, against whose decision there shall be no appeal. **The grant will lapse if no Report is lodged by the due date.**

8. *Payment of Grant.*—Grants will be paid in December after the Reports have been received and found to be in order and passed by the Board of Directors.

9. *Renewal of Grant.*—An Association or Society which has received a Grant shall not be eligible to apply for a renewal of the Grant until after the expiry of three years from the termination of the previous Grant. In disposing of applications the Directors of the Highland and Agricultural Society of Scotland shall keep in view the length of interval that has elapsed since making a previous Grant, giving priority to those Associations or Societies which have been longest without a Grant.

Grants in 1942.

3rd and Final Year—GRANT OF £15.

1. DEESIDE STOCK IMPROVEMENT SOCIETY.
   Convener—John Thomson, J.P. Sylva Cottage, Milltimber, Aberdeenshire.
   Secretary—Peter Ross, 15 Westfield Road, Stonehaven.
   Granted 1940.

2. LOWER DONSIDE HORSE-BREEDING SOCIETY.
   Convener—Patrick Forbes, Oakhurst, Kintore, Aberdeenshire.
   Secretary—W. W. Allan Craig, P.O. Buildings, Kemnay, Aberdeenshire.
   Granted 1940.

3. SHAPANSEY AGRICULTURAL ASSOCIATION.
   Convener—William T. Wood, Balfour Mains, Shapansey, Orkney.
   Secretary—D. L. Kemp, Bayview, Shapansey, Orkney.
   Granted 1940.

4. STONEHAVEN DISTRICT HORSE-BREEDING ASSOCIATION.
   President—A. E. Ergo, Cheyne, Stonehaven.
   Secretary—James B. Connon, Commercial Bank Buildings, Stonehaven.
   Granted 1940.

5. STRATHSPEY FARMERS' CLUB.
   Convener—William Grant, Dell of Rothiemurchus, Aviemore.
   Interim Secretary—Thomas Gordon, Grantown-on-Spey.
   Granted 1940.

6. UPPER DONSIDE AGRICULTURAL SOCIETY.
   Convener—William Ellis, Cairncoullie, Cushnie, Alford, Aberdeenshire.
   Secretary—Alexander Kellas, Hillockhead, Cushnie, Alford, Aberdeenshire.
   Granted 1940.

7. WEST OF CAITHNESS (CLYDESDALE) HORSE-BREEDING SOCIETY.
   Convener—Captain J. H. Davidson, Lower Dounreay, Reay, Caithness.
   Secretary—Andrew Innes, North Calder, Thurso, Caithness.
   Granted 1940.

8. WEST OF FIFE CLYDESDALE ENTIRE HORSE SOCIETY.
Convener—James Butters, Milton, Leuchars, Fife.
Secretary—John Stevens, Estate Office, Crossford, Dunfermline.
Granted 1940.

2nd Year—GRANT of £15.

9. CLACKMANNANSHIRE UNION AGRICULTURAL SOCIETY.
Convener—Robert M'Gee, Blackfaulds, Alloa.
Secretary—G. F. Piggott, Union Street, Alloa.
Granted 1941.

10. HOWE O' THE MEARNS HORSE-BREEDING ASSOCIATION.
Convener—Allan Smith, Drumsleed, Fordoun.
Secretary—Rowland Reed, Solicitor, Commercial Bank Buildings, Laurencekirk.
Granted 1941.

11. KIRRIEMUIR DISTRICT AGRICULTURAL ASSOCIATION.
Convener—Edward Weighton, Caddam, Kirriemuir.
Secretary—W. M. Wallace, National Bank of Scotland Ltd., Kirriemuir.
Granted 1941.

12. MORAYSHIRE CLYDESDALE HORSE-BREEDING ASSOCIATION.
Convener—Stephen Taylor, Kirkhill, Alves, Morayshire.
Secretary—A. J. Morrison, C.E., 87 High Street, Elgin.
Granted 1941.

13. SANDAY AGRICULTURAL ASSOCIATION.
Convener—James Irvine, West Brough, Sanday, Orkney.
Secretary—John Thomson, Ortie, Sanday, Orkney.
Granted 1940. (Grant in abeyance 1940.)

1st Year—GRANT of £15.

14. BIGGAR AND PEEBLES CLYDESDALE HORSE-BREEDING ASSOCIATION.
Convener—James A. Brown, Cormiston Towers Farm, Biggar, Lanarkshire.
Secretary—James Noble, Gowanlea, Symington, Biggar, Lanarkshire.
Granted 1942.

15. MID ARGYLL AGRICULTURAL SOCIETY.
Convener—Provost John M. Brodie, 73 Argyll Street, Lochgilphead, Argyll.
Secretary—J. G. Mathieson, Ri-Cruin, Kilmartin, Lochgilphead, Argyll.
Granted 1942.

CLASS 3.

LOCAL AGRICULTURAL SOCIETIES—GRANTS OF SILVER MEDALS IN AID OF PREMIUMS.

Regulations.—See Volume for 1940 for Regulations and Rules of Competition.

Grants suspended throughout the War.—In January 1941 the Directors agreed that it was undesirable for the Society to encourage the holding of Agricultural Shows during the War, and it was decided, accordingly, that all grants by the Society of money and medals in aid of Local Agricultural Shows be suspended throughout the further duration of the War.

The Societies entitled to grants at the end of the War on resumption of their Shows are detailed in the Volume for 1941.

CLASS 4.

SPECIAL GRANTS—1942.

(1) Annual.

1. Northern Counties Arts and Crafts Society—£20.
Convener—Miss Mackintosh of Raigmore, Raigmore, Inverness.
Joint-Secretary—Mrs Mitford, Berryfield, Lentran, Inverness.
Granted 1922.

2. Scottish National Union of Allotment Holders.
£15 and 15 Medium Silver Medals to be offered as Prizes for best Allotments.
Interim Secretary and Treasurer—Miss H. Thompson, Room No. 21, 130 George Street, Edinburgh.
Granted 1927.

Grants Suspended.

Various grants have been suspended for the further duration of the War (see reference under Class 1). The Societies, &c., entitled to grants at the end of the War, on resumption of their Shows or Competitions, are detailed in the Volume for 1941.

CLASS 5.

FEDERATIONS OF SCOTTISH WOMEN'S RURAL INSTITUTES—GRANTS OF £10.

Regulations, 1942.

1. The Highland and Agricultural Society of Scotland will provide annually a sum not exceeding £150 as special Grants to Federations of Scottish Women's Rural Institutes.

2. *Grant to Federation*, £10.—The amount of the Grant to any one Federation shall not exceed the sum of £10 per annum.

3. *Duration of Grant*.—The Grant will continue for two consecutive years.

4. *Disposal of Applications*.—In disposing of applications for Grants, the Directors of the Highland and Agricultural Society shall keep in view the length of interval that has elapsed since the expiration of the last Grant, giving priority to those Federations which have been longest off the list.

5. *Eligibility to Apply*.—All applications must be at the instance of a properly constituted Federation of Institutes.

6. *Application of Grant*.—**The Grant of £10 shall not be applied as a Grant-in-aid to the general funds of a Federation, but must be offered in the form of Prizes at any Show or Competition held under the auspices of the Federation.**

7. *Announcement of Grant*.—**The offer of Prizes must be announced in the Prize List or Catalogue of the Show or Competition as "presented by the Highland and Agricultural Society of Scotland," or the amount of the Grant must be shown as a separate item of donation in the published statement of Accounts.**

8. *Rules of Competition*.—The Rules of Competition for the Prizes, the funds for which are derived from Grants of the Highland and Agricultural Society of Scotland, shall be such as are generally enforced in the case of Prizes offered from the Federation's own funds.

9. *Report to be Submitted*.—Forms of Report will be furnished to the Secretaries of Federations, and these must be completed and returned to the Society as soon as possible after the Show or Competition and in no case later than **1st November.** These Reports are subject to the approval of the Directors of the Highland and Agricultural Society, against whose decision there shall be no appeal. All Reports must be signed and certified as marked on the Form.

The Grant will lapse if no Report is lodged.

10. *Payment of Grant*.—Payment of the Grant will be made in December after the Reports of the Awards have been received and found to be in order and passed by the Board of Directors.

11. *Renewal of Grant*.—A Federation which has received a Grant for two consecutive years shall not be eligible to apply for a renewal of the Grant until after the expiry of two years from the termination of the previous Grant.

Grants in 1942.

2nd Year.

1. BERWICKSHIRE FEDERATION.
   Convener—Mrs Stevenson, Blackburn, Lauder, Berwickshire.
   Secretary—Miss A. M'B. Cowan, Roselea, Oxton, Berwickshire.
   Granted 1939. (Grants in abeyance 1940, 1941.)

2. DUMFRIESSHIRE FEDERATION.
   Convener—Mrs Ralston, Holmhill, Thornhill, Dumfriesshire.
   Secretary—Mrs Forrester, Kilness, Dumfries.
   Granted 1939. (Grants in abeyance 1940, 1941.)

3. EAST LOTHIAN FEDERATION.
   Convener—Mrs Hay, Belton, Dunbar.
   Secretary—Mrs M'Kemmie, 2 Wemyss Place, Haddington.
   Granted 1938. (Grants in abeyance 1938, 1940, 1941.)

4. MULL, ISLE OF, FEDERATION.
   Convener—Mrs Allan of Aros, Tobermory.
   Secretary—Mrs Cuninghame, Linndhu, Tobermory.
   Granted 1939. (Grants in abeyance 1940, 1941.)

5. ROSS-SHIRE FEDERATION.
   Convener—Mrs Ross, East House, Portmahomack, Ross-shire.
   Secretary—Miss Margaret Rose, Inchrorie, Strathpeffer.
   Granted 1939. (Grants in abeyance 1940, 1941.)

6. STEWARTRY OF KIRKCUDBRIGHT FEDERATION.
   Convener—Mrs Jaffe, Netherhall, Castle-Douglas.
   Secretary—Miss A. R. Parker, Balmakethe, Castle-Douglas.
   Granted 1940. (Grant in abeyance 1940.)

1st Year.

7. BUTE, ISLE OF, FEDERATION.
   Convener—Miss M'Farlane, Meikle Kilchattan, Kingarth, Rothesay.
   Secretary—Miss M. Gray Buchanan, St Margaret's, Ascog, Rothesay.
   Granted 1940. (Grants in abeyance 1940, 1941.)

8. MIDLOTHIAN FEDERATION.
   Convener—Mrs Mercer, Southfield, Dalkeith.
   Secretary—Miss N. Scott Muir, 10 Silverknowes Loan, Davidson's Mains, Edinburgh 4.
   Granted 1940. (Grants in abeyance 1940, 1941.)

GROUP III.—COTTAGES AND GARDENS, &c.

CLASS 6.

LOCAL SOCIETIES, &c.—GRANTS FOR BEST-KEPT COTTAGES AND GARDENS.

CLASS 7.

LOCAL SOCIETIES, &c.—GRANTS OF MINOR SILVER MEDALS FOR BEST-KEPT COTTAGES AND GARDENS, GARDEN PRODUCE, POULTRY, AND HONEY.

REGULATIONS.—See Volume for 1941 for Regulations and Rules of Competition.

GRANTS.—None of the Societies listed in 1941 held a Competition in that year. In the event of any Society holding a Competition in 1942, the respective grants will be made available, as detailed in the Volume for 1941.

GROUP IV.—PLOUGHING, HOEING, AND LONG FARM SERVICE.

1. MEDALS FOR PLOUGHING COMPETITIONS.

The Ploughing Medal will be given to the winner of the first Premium at Ploughing Competitions, provided a Report in the following terms on the official form is made to the Secretary, within one month of the Competition, by a Member of the Society. Forms of Report to be had on application.

FORM OF REPORT.

I, of , Member of the Highland and Agricultural Society, hereby certify that I attended the Ploughing Match of the Association at in the county of on the when ploughs competed ; of land were assigned to each, and hours were allowed for the execution of the work. The sum of £ was awarded as follows :—

[*Here enumerate the names and designations of successful Competitors.*]

RULES OF COMPETITION.

1. All Matches must be at the instance of a Local Society or Ploughing Association, and no Match at the instance of an individual, or confined to the tenants of one estate, will be recognised.

2. The title of such Society or Association, together with the name and address of its Secretary, must be registered with the Secretary of the Highland and Agricultural Society of Scotland, 8 Eglinton Crescent, Edinburgh.

3. Not more than one Match in the same season can take place within the bounds of the same Society or Association.

4. All reports must be lodged within one month of the date of the Match, and certified by a Member of the Highland and Agricultural Society who was present at it.

5. A Member can report only one Match ; and a Ploughman cannot carry more than three Medals in the same season.

6. To warrant the grant of the Medal, there must have been 12 Ploughs in actual competition for the medal (*i.e., in the particular class for which the medal was offered*) and not less than £3 awarded in Prizes by the Local Society. The Medal to be given to the winner of the first prize.

7. The Local Society or Ploughing Association shall decide what class of ploughs shall compete for the Medal, and if so agreed, may offer it for competition to the class of plough most generally in use in the district.

8. The Local Society or Committee may, if they desire, arrange to let each Ploughman have one person to guide the horses for the first two and the last two furrows, but in no case shall Ploughmen receive any other assistance, and their work must not be set up or touched by others. Attention should be given to the firmness and sufficiency of the work below, more than to its neatness above the surface.

9. The Local Committee is required to fix the time to be allowed for ploughing the portion of land, and they are recommended that the time be at the rate of not more than fourteen hours per imperial acre on light land, and eighteen hours on heavy or stony land.

NOTE.—The attention of the Directors of the Society has frequently been drawn to certain irregularities which have occurred in connection with the conduct of Ploughing Matches and the completion of the Reports thereon. Complaints have been made (*a*) that the allotted amount of ground has not been ploughed, within the specified time, by the competitor awarded the first prize; (*b*) that the Report sent to this Society has been signed by a Member of the Society who was not present at the Match. It has to be pointed out that any infringement of the above Rules by a Local Society or Ploughing Association will render that Society or Association liable, at the discretion of the Board of Directors, to be debarred from receiving the Society's Medals.

2. MEDALS FOR HOEING COMPETITIONS.

The Minor Silver Medal will be given to the winner of the first Premium at Hoeing Competitions, provided a Report on the official form is made to the Secretary within a month of the Competition by a Member of the Society. Forms of Report to be had on application.

RULES OF COMPETITION.

1. All Matches must be at the instance of a Local Society or Hoeing Association, and no Match at the instance of an individual, or confined to the tenants of one estate, will be recognised.

2. The title of such Society or Association, together with the name and address of its Secretary, must be registered with the Secretary of the Highland and Agricultural Society of Scotland, 8 Eglinton Crescent, Edinburgh.

3. Not more than one Match in the same season can take place within the bounds of the same Society or Association.

4. All reports must be lodged within one month of the date of the Match, and certified by a Member of the Highland and Agricultural Society who was present at it.

5. A Member can only report one Match; and same Competitor cannot carry more than three Medals in the same season.

6. To warrant the grant of the Medal there must have been twelve hoes in Competition, and not less than Three Pounds awarded in prizes by the Local Society or Association. The Medal to be given to the winner of the first prize.

7. The time to be allowed to be decided by the local Committee, but in no case to exceed two hours for two drills of 100 yards each, the third drill being unoccupied, so that Competitors do not interfere with their neighbour's work.

8. Competitors must finish their work as they go along—no turning back or after-dressing allowed. Hand-picking or transplanting shall be strictly prohibited.

9. A Committee shall be appointed to watch the work, and any Competitor found transplanting or otherwise not complying with the Rules shall have his number withdrawn, and be debarred from receiving any prize which might otherwise have been awarded to him.

NOTE.—Medals will be awarded under similar conditions for Competitions in hand-singling.

3. CERTIFICATES AND MEDALS FOR LONG FARM SERVICE.

Certificates and Silver Medals for long service will be awarded by the Society to farm servants, male or female, having an approved service in Scotland of not less than thirty years (not necessarily continuous) —(*a*) with one employer on the same or different holdings; (*b*) on the same holding with different employers.

Special Certificates and Gold Medals are also awarded to farm servants, male or female, having an approved service in Scotland of not less than forty-five years (not necessarily continuous), on similar conditions of employment as the above. (*Note.*—The issue of Gold Medals has been temporarily suspended for the further duration of the War.)

Forms of Application are obtainable from the Secretary, 8 Eglinton Crescent, Edinburgh.

War Service to count towards the time required for qualification, where farm servants have returned to same service or employment with same farmer or his family.

The award is strictly confined to **Farm** workers, such as Ploughmen, Cattlemen, and Shepherds.

Domestic and House Servants and Estate workers, such as Foresters, Carters, Grooms, &c., are not eligible.

MEMBERS ADMITTED SINCE THE LIST WAS PUBLISHED IN APRIL 1941.

ARRANGED ACCORDING TO SHOW DISTRICTS.

(Elected 4th June 1941 and 7th January 1942.)

1.—GLASGOW DIVISION

LANARK

Admitted
1941 Buchanan, A. N. M., 'The Scottish Farmer,' 93 Hope Street, Glasgow, C.2

2.—PERTH DIVISION

ANGUS

1941 Forbes, Colonel Robert, D.S.O., M.C., H.M. Inspector of Schools, Balglassie, Forfar

4.—EDINBURGH DIVISION

MID-LOTHIAN

1941 Brickman, Francis, Halflakiln, Tynehead
1941 Cameron, Alfred E., M.A., D.Sc., 8 West Savile Road, Craigmillar Park

5.—ABERDEEN DIVISION

KINCARDINE

1941 Robertson, Robert Murray, Ury Estates Office, Stonehaven

6.—DUMFRIES DIVISION

DUMFRIES

1942 Anderson, James, Lochend, Beeswing, Dumfries
1942 Little, George, Tinwald Parks, Torthorwald, Dumfries

7.—INVERNESS DIVISION

INVERNESS

1941 Davidson, William, 4 Falcon Square, Inverness

MORAY

1942 Alexander, T. G., Newton Farm, Garmouth

ENGLAND AND WALES

1942 Gordon, P. G., Southburn Estate Office, Driffield, East Yorks.
1942 Prince-Smith, Sir William, Bart., Southburn, Driffield, East Yorks.

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